PACE INSTITUTE OF TECHNOLOGY & SCIENCES: ONGOLE
(An Autonomous)

ACADEMIC REGULATIONS R-18 FOR B.Tech (REGULAR)

(CHOICE BASED CREDIT SYSTEM)

Applicable for the students of B.Tech (Regular) from the Academic Year 2018-19
&
B.Tech Lateral Entry Scheme from the Academic Year 2019-20

1. ELIGIBILITY CRITERIA FOR ADMISSION

The eligibility criteria for admission into B.Tech programme shall be as per the guidelines issued by the Andhra Pradesh State Council of Higher Education (APSCHE) and/or by any other competent authority.

2. PROGRAMMES OFFERED (UNDER GRADUATE)

A student shall be offered admission into any one AICTE-approved programme as given below:

S.No	PROGRAMME
01	Civil Engineering (CE)
02	Electrical and Electronics Engineering (EEE)
03	Mechanical Engineering (ME)
04	Electronics and Communication Engineering (ECE)
05	Computer Science and Engineering (CSE)
06	Information Technology (IT)
07	Automobile Engineering (AME)

3. AWARD OF DEGREE

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

i. 4 Year B.Tech Programme:

- The Student shall study a course for not less than four academic years and not more than eight academic years.
- The student shall register for 160 credits and secure all the 160 credits.
- The students, who fail to fulfil all the academic requirements for the award of degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech Programme.

- Students shall secure a satisfactory grade (SA) in all Mandatory Courses (Non Credit Courses/Activities).
- No disciplinary action pending against the student by the time of the completion of his/her course. If any disciplinary action is pending against any student, he/she should not be awarded with the degree.

ii. 3 Year B.Tech Programme under Lateral Entry Scheme (LES):

- The Student shall study a course for not less than three academic years and not more than six academic years.
- The student shall register for 120 credits and secure all the 120 credits.
- The students, who fail to fulfil all the academic requirements for the award of degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech programme.
- Students shall secure a satisfactory grade (SA) in all non-credit courses/ activities. (Non Credit Courses/Activities).
- No disciplinary action pending against the student by the time of the completion of his/her course. If any disciplinary action is pending against the student, he/she should not be awarded with the degree.

4. MEDIUM OF INSTRUCTION

The medium of instruction shall be English in all academic activities.

5. MINIMUM INSTRUCTION DAYS

The minimum instruction days for each Semester shall be 90.

6. CATEGORIZATION OF COURSES

Choice Based Credit System (CBCS)

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which students can take courses of their choice, learn at their own pace and adopt an interdisciplinary approach to learning.

The curriculum of each programme shall contain various courses indicated in the following categories to train the students for employment, higher learning & research and entrepreneurship.

i. **Humanities and Social Sciences (HS):** These courses include Technical English, Environmental Science and Engineering, Industrial Management, Managerial Economics & Financial Accountancy, Communication skills etc.

ii. **Basic Sciences (BS):** These courses include Mathematics, Physics, Chemistry, Biology etc.

iii. **Engineering Sciences (ES):** These courses include Workshop, Drawing, Basic Electrical/Mechanical/Computer etc.

iv. **Professional Core (PC):** These courses are the core courses that provide the requisite foundation in the chosen Branch of Engineering.

v. **Professional Elective (PE):** These courses are the elective courses opted by the students relevant to the chosen branch of engineering that provides the requisite foundation in a specific area of specialization.

vi. **Open Elective (OE):** These courses are inter-disciplinary in nature offered by other departments and/or any emerging subjects.

The department offers an elective course (PE/OE), if the number of students registered in such a course is a minimum of 20.

vii. **Add-on Courses:** Add-on courses are Skill enhancement courses for the students in the respective branch of engineering.

viii. **MOOCS/Self Study Courses:** An opportunity is given to the students to choose one online course offered by SWAYAM-NPTEL / Foreign institutions/ reputed universities to enhance the learning skills or a self-study course under the guidance of the faculty advisor to enhance the self-learning capabilities which are having Global acceptance.

ix. **Personality Development (PD):** These courses include Integrated Learning Practices (ILPs), Mandatory Courses (MCs) & Extra-curricular/Co-curricular activities and help the students into a well-trained professionals and good human beings with a high employability potential, good communication skills, soft skills, good engineering practices, personality transformation, professional presentation skills and networking skills.

x. **Mandatory Courses (MC):** The Professional Ethics & Human Values, Employability Enhancement Skills. Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge, Problem-assisted learning and Problem-based learning are non-credit courses relevant to the value education and also for enhancing employability skills.

- In addition to the above courses to enhance the overall personality & character of students and make them aware of social needs, the extra-curricular/co-curricular activities are included, which do not carry any credits. These activities include National Service Scheme (NSS), National Cadet Corps (NCC), Sports & Games and Professional Club Activities.
- The Students shall undergo Industrial /In-house training to expose them to the practical environment.
- A faculty advisor or counselor shall be assigned to a group of 20 students, and he/she will advise the students about the under graduate programme, its course structure and curriculum, choice/option for course based on their competence, progress, pre-requisites andinterest.

xi. **Mini-Project:** A student is required to undergo a mini project of his/her choice by applying theoretical concepts to develop a practical component /element/system that includes design/ testing/ analysis.

xii. Summer School Practices:

Industry Internship: Internship must involve practical work related to systems engineering, industry practices etc. The internship can be carried out at premier institutions/ research laboratories/industries.

7. CREDIT ASSIGNMENT

Each course is assigned a certain number of credits based on the following criteria.

Contact hours per week			Credits
L	**T**	**P**	
1	0	0	1
0	1	0	1
0	0	2	1

8. REGISTRATION OF COURSES

The entire programme of study is for four academic years (three academic years in case of LES), all the years are on semester pattern. As per the curriculum the student shall register for 160 credits from all the courses as specified for the programme of study under regular four years. As per the

curriculum the student shall register for 120 credits from all the courses as specified for the programme of study under regular four years.

9. ASSESSMENT AND EVALUATION

The performance of a student in each course shall be evaluated based on Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) or only Continuous Internal Evaluation.

S.No	Category of Course	Marks	
		CIE	SEE
1	Theory Courses	40	60
2	Laboratory Courses	40	60
3	Mandatory Courses	100	-
4	Mini Project	100	-
5	Seminar	100	-
6	Internship	100	-
7	Project Work	80	120

THEORY COURSES

Continuous Internal Evaluation (CIE):

The CIE of a theory course consists of four components as indicated in the following table.

S.No	**Component**	**Marks**
1	Mid-Term- Descriptive Examinations	20
2	Online Quiz Examinations	10
3	Assignments with Viva Voce	05
4	Class Room Test	05
	Total	**40**

a) Mid Term Descriptive Examinations (20 Marks):

There shall be two mid-term descriptive examinations of 120 minutes each. The mid-term examinations shall be conducted with syllabi from units I,II & first half of III for the first mid and second half of III, IV & V units for the second mid. In each theory course, the question paper for the mid-term descriptive examination consists of four questions. A student is required to answer all four questions for maximum 20 marks.

b) Online Quiz Examinations (10 marks):

Two online quiz examinations of 20 minutes each shall be conducted with syllabi from units I,II & first half of III for the first mid and second half of III, IV & V units for the second mid. The online quiz examination shall have 20 multiple choice questions for maximum 10 marks.

c) Assignments with Viva Voce (5 Marks):

A Student shall submit five Assignments with Viva Voce to the concerned faculty from all five units. The Assignment shall be evaluated by the concerned faculty. The average of best four assignment marks shall be considered for awarding 05 marks.

d) Class Room Test (5 Marks):

There shall be conducted 5 Class Room Tests from 5 units. The tests shall be conducted and evaluated by the concerned faculty. The average of best four class room tests considered for awarding 05 marks.

Assignment with Viva Voce and Class Room Tests marks will be evaluated at the end of the Semester.

CIE is Computed as following: Finalized internal marks can be calculated with 80% weightage for the better of the two mid-term examinations and 20% for the other shall be considered for marks of 30 and is added to Assignment with Viva Voce 05 marks, Class Room Tests 05 marks for awarding total 40 marks.

There shall be no Assignment with Viva Voce and Class Room Tests for Applied/Engineering Physics Course. Finalized internal marks for Applied/Engineering Physics Course can be calculated with 80% weightage for the better of the two mid-term examinations and 20% for the other shall be considered for marks of 30 and is added to Virtual Lab-Assignments 10 marks for awarding total 40 marks.

For the courses like Engineering Graphics, Machine Drawing and Design courses the CIE shall be 40 marks (20 marks for day-to-day work, 20 marks for two mid-term examinations) and 60 marks for SEE. A student is required to answer all 4 questions for maximum 20 marks. The final assessment of mid-term examinations is based on 80% weightage for the better and 20% for the other.

Semester End Examinations (SEE)

The semester end examinations for theory courses (including Engineering Graphics and Engineering Drawing) will be conducted covering all the units for 60 Marks. The question paper consists of two parts. In Part-A There shall be compulsory first question containing 5 two marks questions and these are to be set from the entire syllabus. In Part-B There shall be one question from each unit with internal choice. Each question carries 10 marks. Each theory course shall consist of five units of syllabus. Part-A and Part-B put together are given for 60 Marks.

Special Subjects: The SEE question paper for Design courses like Building Planning & Drawing, Design & Drawing of Steel Structures, and Design & Drawing of Steel Structures Reinforced Concrete Structures consists of two parts. In Part-A there shall be one question out of 2 questions is to be answered for 24 marks and in Part-B 3 Questions out of 5 Questions are to be answered of which each carries 12 Marks in 3 hours time. Part-A and Part-B put together are given for 60 Marks.

LABORATORY COURSES

Continuous Internal Evaluation (CIE)

The continuous internal evaluation for laboratory courses is based on the following parameters:

Parameter	Marks
Day-to-day work	20
Internal test	10
Record	05
Viva voce	05
Total	40

Semester End Examinations (SEE)

The performance of the student in laboratory courses shall be evaluated jointly by internal and external examiners for 3 hours duration as per the parameters indicated below:

Parameter	Marks
Procedure/Algorithm	10
Experimentation/Program Execution	15
Observations/Calculations/Testing	15
Result/Inference	10
Viva Voce	10
Total	**60**

MANDATORY COURSES (NON CREDIT COURSES)

Mandatory courses are evaluated by the mode of a Presentation/ Comprehensive-Viva Voce/ Evaluation of Assignments. A student shall secure a minimum 40% of marks to get a satisfactory grade (SA). Otherwise unsatisfactory grade (US) will be indicated. However, a student who secures "US" grade /abstains shall reappear in the subsequent semester(s).

MINI-PROJECT

A student is required to undergo a mini project of his/her choice by applying theoretical concepts to develop a practical component /element/system that includes design/ testing/ analysis. The performance of a student in the mini project shall be evaluated by a three-member committee constituted by the HoD as per the following parameters:

Parameter	Marks
Mini project Report	30
Innovation	25
Presentation	25
Viva Voce	20
Total	**100**

The performance of a student in mini project shall be evaluated based on two reviews, each carries 100 marks. The average marks of these two reviews will be awarded. However, a student who fails to secure minimum

40% marks or abstains will be permitted to reappear in the subsequent semester(s). There shall be no semester end examination.

SEMINAR

A student shall deliver a seminar on any emerging topic of his/her choice from the core technical domain. The student shall submit a duly-certified seminar report. A three-member committee constituted by the HoD will finalize the CIE marks based on the following parameters:

Parameter	Marks
Seminar report	30
Innovation	20
Presentation	30
Viva Voce	20
Total	**100**

A student who fails to secure minimum 40% marks or abstains will be permitted to reappear in the subsequent semester(s). There shall be no semester end examination.

INTERNSHIP

Internship must involve practical work related to industry practices. The students shall undergo internship for a period of minimum 4 weeks continuously at the end of VI semester and shall be evaluated in VII semester. The internship can be carried out at premier institutions/ research laboratories/industries.

A student shall submit a report on the training undergone, along with a certificate from the organization. A three-member committee constituted by the HoD shall finalize the CIE marks based on the following parameters:

Parameter	Marks
Internship Report	50
Presentation	30
Viva Voce	20
Total	**100**

The Internal guide shall monitor the work progress and regularity of the students in periodic intervals. No financial support shall be provided by the Institute for Internship.

A student, who fails to secure minimum 40% marks or abstains, will be permitted to reappear in the subsequent semester(s). There shall be no semester end examination.

Project Work

A student is required to undertake a project work by using the knowledge acquired by him/her during the course of study. The student is expected to design and build a complete system or subsystem on an area of interest. The project work consists of two parts namely, project literature review and project implementation. A project work shall be carried out by a batch minimum of 4 Student members under a faculty supervisor.

i. **Continuous Internal Evaluation:**

The CIE for project work shall be based on project survey and project implementation and is evaluated by a three-member committee consisting of two senior faculties and a project supervisor constituted by the HoD.

- **Project Literature Review:**

The performance of a student in project survey shall be evaluated based on the following parameters:

Parameter	Marks
Literature Review	15
Presentation	15
Viva Voce	10
Total	40

- **Project Implementation:**

The performance of a student in project implementation shall be evaluated based on two reviews, each carries 40 marks. The average marks of these two reviews will be considered. The evaluation criterion of each review is based on the following parameters:

Parameter	Marks
Contribution	10
Innovation	10
Presentation	10
Viva Voce	10
Total	**40**

The marks secured by a student in project literature review and project implementation shall be awarded cumulatively as CIE of the project work in VIII semester.

ii. Semester End Examination:

A batch of students shall submit a duly-certified project report to the department in a specified time. They shall make a presentation on the project work before a three-member committee consisting of external examiner, internal examiner (HoD) and a project supervisor. The performance of each student is evaluated as per the following parameters:

Parameter	Marks
Project report	40
Innovation	30
Presentation	20
Viva Voce	15
Research Publication (Seminar/Conference/Symposium/Journal)	10
Scope of Implementation	05
Total	**120**

A student who fails to secure minimum 40% marks or abstains is permitted to re-appear in the advanced supplementary examinations or when offered next.

OTHER COURSES

a. Online (MOOCS) / Self Study Course:

Institute encourages the students to register and satisfy for MOOCs Certificate. A student is awarded certificates for 4 weeks programme – 1 credit, 8 weeks programme – 2 credits and 12 weeks programme – 4 credits.

b. Add-On Courses:

ADD-ON Courses are provided by the Institution with Industry Interaction to enhance skills in the domain of the study.

c. Extra-Curricular / Co-Curricular Activities:

The participation of a student is compulsory in any one of the extra-curricular/co-curricular activities (non-credit) such as NSS, NCC, Sports & Games, Professional club activities during the semesters I to VII for

award a Satisfactory grade (SA). The performance of a student in the extra-curricular/co-curricular activities is evaluated during VII semester by a three member committee constituted by HoD.

For physically disabled students, the satisfactory grade (SA) will be awarded, if he/she obtains certificate in co-curricular activities such as essay writing, debate competitions, technical & general quizzes, symposium etc.

However, a student who secures unsatisfactory grade (US) shall reappear in the subsequent semester(s).

10. ATTENDANCE REQUIREMENTS

a. A student is eligible to write the Semester End Examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.
b. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in two times upto III Year II Semester and once in IV Year may be granted by the College Academic Committee on medical grounds.
c. A stipulated fee shall be payable towards condonation of shortage of attendance.
d. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
e. Shortage of Attendance below 65% in aggregate shall not be condoned.
f. A student who is shortage of attendance in semester may seek re-admission into that semester when offered within one week from the date of the commencement of class work.
g. Students whose shortage of attendance is not condoned in any semester are not eligible to write their Semester End Examination of that class.

11. MINIMUM ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.10.

a. A student shall be deemed to have satisfied the minimum academic requirements, if he/she gains the credits allotted to each course and secures not less than a minimum 35% of marks exclusively at the Semester End

Examination. However, the student should secure minimum 40% of marks in both CIE and SEE put together to be eligible for passing the course.

b. A student shall be promoted from II Semester to III Semester if he/she fulfills the minimum attendance requirement.

c. A student will be promoted from IV Semester to V Semester if he/she fulfills the academic requirement of 50% of the credits up to either III Semester or IV Semester from all the examinations, whether the candidate appears or not for the examinations and secures prescribed minimum attendance in IV Semester.

The students admitted under Lateral Entry Scheme shall be promoted to the V semester, if he/she fulfills the minimum attendance requirement in IV Semester.

d. A student will be promoted from VI Semester to VII Semester if he/she fulfills the academic requirement of 50% of the credits up to either V Semester or VI Semester from all the examinations, whether the candidate appears or not for the examinations and secures prescribed minimum attendance in VI Semester.

The students admitted under Lateral Entry Scheme shall be promoted to the VII semester, if he/she fulfills the academic requirement of 50% of the credits up to either V Semester or VI Semester from all the examinations, whether the candidate appears or not for the examinations and secures prescribed minimum attendance in VI Semester.

e. The Students who fail to earn 160 credits as indicated in the course structure within 8 academic years from the year of admission shall forfeit their seat in B.Tech programme and admission stands cancelled.

f. The students admitted under Lateral Entry Scheme, who fail to earn 120 credits as indicated in the course structure within 6 academic years from the year of admission, shall forfeit their seat in B.Tech programme and admission stands cancelled.

12. PROCEDURES FOR SEMESTER END EXAMINATIONS

i. **Supplementary examinations:** There shall be supplementary examinations along with regular semester end examinations for a student to reappear in the course(s) he/she failed or not attempted.

ii. **Advanced supplementary examinations:** Students who fail in the courses in VIII semester (theory/project work) can reappear for advanced supplementary examinations within one month after the declaration of the revaluation results. However, the students who fail in advanced supplementary examinations shall reappear when offered next along with regular students.

iii. **Recounting:** A student, who wishes to verify the total marks obtained by him/her in any theory course in SEE can apply for recounting in response to the notification along with the prescribed fee. The outcome of the recounting gets reflected in the results sheet and grade card.

iv. **Revaluation:** A student who wishes to apply for revaluation of a theory course in SEE can submit an application along with the prescribed fee as per the notification issued.

   a. If the variation in marks of the first valuation and revaluation is ≤ 15% of the total marks, then the better of the two evaluations shall be considered as final marks.

   b. If the variation of marks between the first valuation and revaluation is >15% of the total marks, there shall be a third evaluation by another examiner. The average marks of two nearer evaluations shall be taken into consideration. In case of any fractional value of marks, it can be rounded off to the next integer value.

   c. If a student secures a higher grade in the revaluation, that grade will be declared as the final grade. Otherwise, the original grade will remain valid.

13. AWARD OF LETTER GRADES

A letter grade and grade points shall be awarded to a student in each course based on his/her performance as per the 10-point grading system given below.

Marks (Max:100)	Letter Grade	Grade Point	Level
≥ 90	O	10	Outstanding
80 to <90	S	9	Excellent
70 to <80	A	8	Very Good
60 to <70	B	7	Good
50 to <60	C	6	Fair
40 to <50	P	5	Pass
<40	F	0	Fail
--	Ab	0	Absent

Marks (Max:100)	Letter Grade	Grade Point	Level
≥ 40	SA	-	Satisfactory
< 40	US	-	Unsatisfactory
--	Ab	-	Absent

a. A student who secures from 'O' to 'D' grades in a course is declared to have successfully completed the course, and is deemed to have secured the credits assigned to that course.

b. A student who secures "F" grade in any course shall be considered "Failed" and is required to reappear as "Supplementary student" in SEE, as and when offered. In such cases, his/her CIE marks in those courses will remain same as obtained earlier.

c. A student, who is absent from any examination shall be treated as "Failed".

d. In general, a student shall not be permitted to repeat any course (s) for the sake of "Grade improvement" or "SGPA/CGPA improvement".

e. As per AICTE guide lines, If a student acquires additional 20 credits through online Certification (approved MOOCs), he/she will be awarded Graduate degree with Honours with subjected to JNTUK instructions.

If a Student from CE,EEE,ME,ECE & AME secures 20 credits from MOOCs courses (apart from Courses mentioned in Course Structure) in Computer Science & Engineering related courses is he/she will be awarded with additional Minor Engineering with Computer Science & Engineering with subjected to JNTUK instructions.

14. COMPUTATION OF SGPA & CGPA

a. Semester Grade Point Average (SGPA)

The performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is the ratio of sum of the product of the number of credits and the grade points scored by a student in all the courses to the sum of the number of credits of all the courses.

SGPA (S_i) = Σ (C_i x G_i) / ΣC_i

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

b. Cumulative Grade Point Average (CGPA)

The CGPA is a measure of the overall cumulative performance of a student. The CGPA is calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme.

CGPA = Σ (C_i x S_i) / ΣC_i

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

c. The SGPA and CGPA are rounded off to 2 decimal points and reported in grade cards.

15. AWARD OF CLASS

A student, who satisfies the minimum requirements prescribed for the completion of a programme, is eligible for the award of B.Tech degree and he/she shall be placed in one of the following four classes on a 10 point scale.

Class Awarded	**CGPA to be secured**	From the CGPA secured from 160 Credits
First Class with Distinction	≥ 7.75 with no subject failures	
First Class	≥ 6.75 with subject failures	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 4.75 to < 5.75	

Equivalent percentage = (CGPA – 0.75) x 10

16. GAP YEAR

a. A student is permitted to make use of the gap year facility at the beginning of V / VII semester of the programme and undergo training programs at premier institutions / research laboratories/ industries for a maximum period of one year (two consecutive semesters of academic year), if he/she secures a CGPA of 7.75 and above with no backlog of courses.

b. A student is permitted to avail the gap year facility only once during the entire course of study.

c. The students are permitted to re-join the programme after availing gap year facility. However, their re-joining is subject to the regulations prevailing at that time.

d. The total period for completion of the programme reckoned from, the commencement of the first semester to which the student is admitted shall not exceed the maximum period in order that the student is eligible for the award of the degree.

e. If a student fails to report to the department after the expiry of 2 semesters, his/her readmission will be subject to the decision of competent authority.

f. A student seeking a gap year needs to apply in the prescribed format before the last working day of the running semester. The application submitted by the student shall be evaluated by Department Academic Committee and forwarded to the head of the institution for approval.

g. The duration of the gap year shall be reflected in the consolidated grade card.

17. DISCIPLINE

a. A student is required to observe discipline and decorum both inside and outside the college and not to indulge in any activity that may tarnish the prestige of the college. The head of the institution shall constitute a disciplinary committee to enquire into acts of indiscipline and notify the college about the disciplinary action taken. In case of any serious disciplinary action, which leads to suspension or dismissal, a committee shall be constituted by head of the institution for taking final decision.

b. Those students who indulge in examination related malpractices shall be punished as per the scale of punishment notified in Annexure-I.

c. Those students involved in the illegal acts of ragging shall be punished as per the provisions of Act 26, 1997 of Govt. of Andhra Pradesh (Annexure-II).

18. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The college may revise, amend or change the regulations, curriculum, syllabus and scheme of examinations from time to time subject to decisions/recommendations of Board of Studies and the College Academic Council.

19. WITHHOLDING OF RESULTS

If a student fails to clear dues, if any, payable to the institution or any case of indiscipline is pending against him, the result of the student will be withheld, and also the award of his/her degree shall be withheld in such cases.

20. TRANSITORY REGULATIONS

a. A student, who is detained or discontinued in the semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those students who have already passed the courses in the earlier semester(s) he/she is originally admitted into and substitute courses/additional courses are offered in place of them as approved by the Board of Studies.

b. In general, after transition, there will be a fitment formula approved by the competent authority in order to balance course composition and the number of credits.

c. Students admitted by transfer from other institutions shall follow transitory regulations with suitable fitment formulae approved by the competent authority.

d. A student who is seeking readmission shall apply in the prescribed format within one week after the commencement of the class work. However, the readmission of a student shall be approved by the competent authority.

21. COURSE CODE

The Course Codes will be given by the departments concerned to the course. Each course code contains 8 characters. The 8 characters for each subject will be filled as per the following description.

1	2	3	4	5	6	7	8

1 Character : Institute Name as '**P**'

2,3 Characters: Year of Commencement of Regulations as '**18**'

4,5 Characters: Subject/Branch Category such as

HS for Humanities and Social Science Courses

BS for Basic Science Courses

ES for Engineering Science Courses

CE for Civil Engineering Courses

EE for Electrical & Electronics Engineering Courses

ME for Mechanical Engineering Courses

EC for Electronics & Communication Engineering Courses

CS for Computer Science & Engineering Courses

IT for Information Technology Courses

AE for Automobile Engineering Courses

MC for Mandatory Courses

PD for Personality Development

6 Character: Mode of Subject Learning and Evaluation such as

T for Theory Courses

L for Laboratory Courses

S for Seminar

P for Project

M for Mini Project

V for Viva Voce

E for Professional Elective Courses

O for Open Elective Courses

I for Internship

7,8 Characters: Serial number of the course taught by the department inthat Semester such 01, 02, 03, ...etc

22. GENERAL

- Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
- The academic regulations should be read as a whole for the purpose of any interpretation.
- In case of any doubt or ambiguity in the interpretation of the aboverules, decision of the competent authority is final and binding.
- The college may change or amend academic regulations or syllabi at any time subject to approval of the competent authority and the changes or may be apply the amendments made to all students with effect from the dates notified.

23. STATUTORY DECLARATION

In case the regulations do not specify application of an appropriate rule in a unique case, the decision of the competent authority of the college shall be final.

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ANNEXURE-I

MALPRACTICE RULES

DISCIPLINARY ACTION FOR MALPRACTICE/IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper Conduct	Punishment
1 (a)	If a student possesses or tries to access 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)	If a student 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.	If a student is found to have 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. The Hall Ticket of the candidate is to be cancelled.
3.	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 and forfeits the 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. The candidate is also debarred for two consecutive semesters from class work and all Semester End Examinations. The

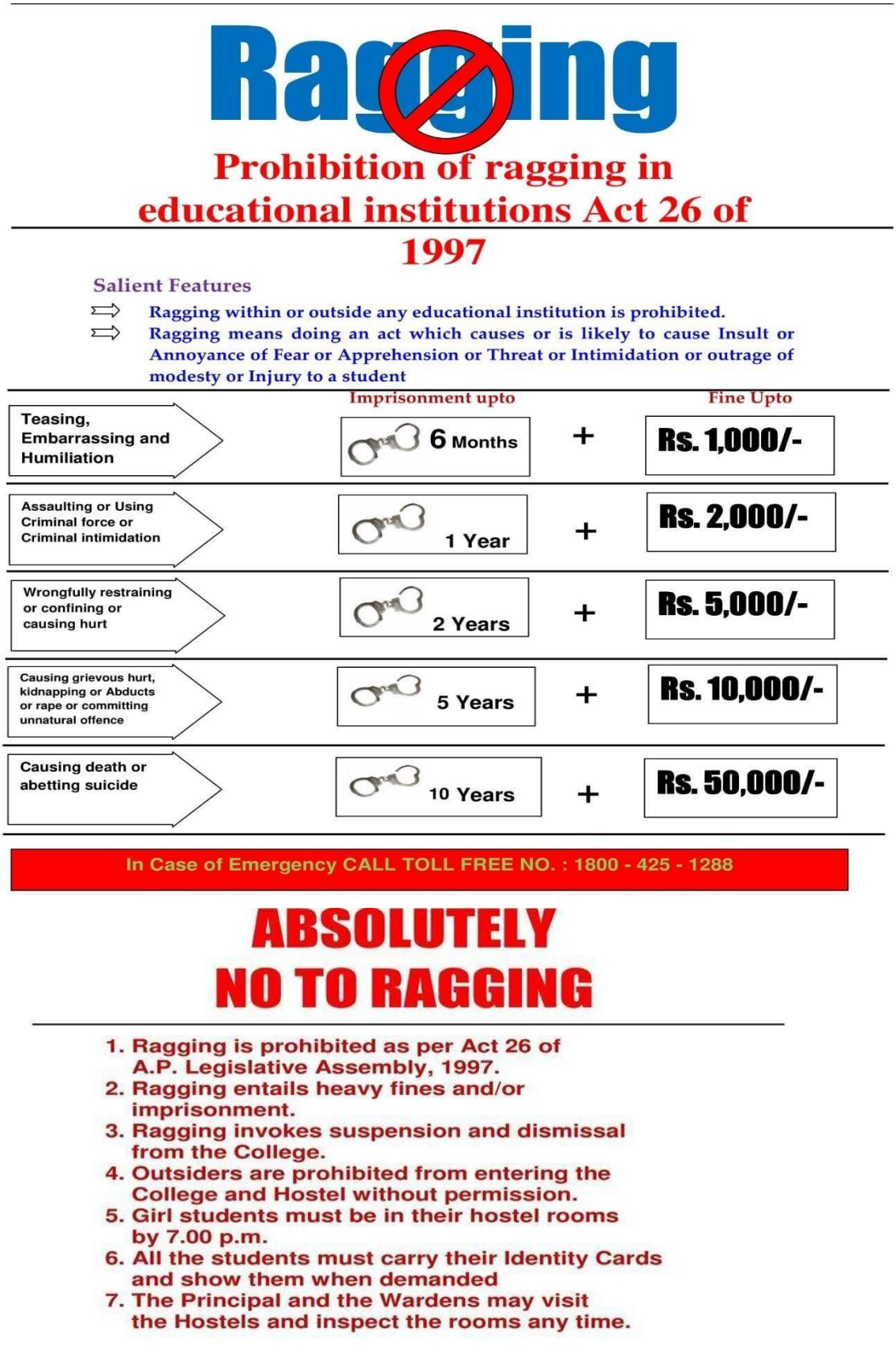
		continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is to be registered against him.
4.	If a student smuggles inside the exam hall an Answer book or additional sheet or takes out or Arranges to send out the question paper 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. The candidate is also debarred for two consecutive semesters from class work and all Semester End Examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	If a student 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 the subject.
6.	If a student refuses to obey the orders of the Chief Superintendent/Controller of Examinations / 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.	Such a student(s) 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. The candidates also are to be debarred and forfeited their seats. In case of outsiders, they will be handed over to the police and a police case is to be registered against them.

7.	If a student leaves the exam hall taking away answer script or intentionally tears 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. The candidate is also debarred for two consecutive semesters from class work and Semester End Examinations. The continuation of the course by the candidate is subjected to the academic regulations in connection with forfeiture of the seat .
8.	If a student possesses 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. The candidate is also to be debarred and forfeited the seat.
9.	If a 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 shall be expelled 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. The candidate is also to be debarred and forfeited the seat. Person(s) who do not belong to the College will be handed over to police and, a police case shall be registered against them.
10.	If a student 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.
11.	If copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester examinations.

Malpractices identified by squad or special invigilators

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

ANNEXURE-II


Ragging
Prohibition of ragging in educational institutions Act 26 of 1997
Salient Features
Ragging within or outside any educational institution is prohibited.
Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student
Imprisonment upto
Fine Upto
Teasing, Embarrassing and Humiliation
6 Months
+
Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation
1 Year
+
Rs. 2,000/-
Wrongfully restraining or confining or causing hurt
2 Years
+
Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence
5 Years
+
Rs. 10,000/-
Causing death or abetting suicide
10 Years
+
Rs. 50,000/-
In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288
ABSOLUTELY NO TO RAGGING
1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

I YEAR I SEMESTER								
S.No.	Course Code	Course	L	T	P	Credits	Internal	External
1	P18MCT01	Induction Program	3 Weeks			-	-	-
2	P18HST01	English-I	3	0	0	3	40	60
3	P18BST01	Mathematics-I	3	0	0	3	40	60
4	P18BST02	Engineering Chemistry	3	0	0	3	40	60
5	P18EST01	Basic Electrical & Electronics Engineering	3	0	0	3	40	60
6	P18EST03	C Programming for problem Solving	3	0	0	3	40	60
7	P18HSL01	English language communication skills Lab	0	0	3	1.5	40	60
8	P18BSL04	Engineering Chemistry Lab	0	0	3	1.5	40	60
9	P18ESL01	Basic Electrical & Electronics Engineering Lab	0	0	3	1.5	40	60
10	P18ESL03	C-Programming for problem solving Lab	0	0	3	1.5	40	60
Total			15	0	12	21	360	540

I YEAR II SEMESTER								
S.No.	Course Code	Course	L	T	P	Credits	Internal	External
1	P18HST02	English-II	3	0	0	3	40	60
2	P18BST02	Mathematics-II	3	0	0	3	40	60
3	P18BST04	Engineering Physics	3	0	0	3	40	60
4	P18EST04	Python Programming	3	0	0	3	40	60
5	P18EST02	Engineering Graphics	1	0	3	2.5	40	60
6	P18BSL02	Engineering Physics Lab	0	0	3	1.5	40	60
7	P18ESL04	Python Programming Lab	0	0	3	1.5	40	60
8	P18ESL02	Engineering Workshop	0	0	3	1.5	40	60
9	P18MCT02	Environmental Science	2	0	0	-	-	-
Total			15	0	12	19	320	480

II YEAR I SEMESTER								
S.No.	Course Code	Course	L	T	P	Credits	Internal	External
1	P18EST05	Engineering Mechanics	3	1	0	4	40	60
2	P18MET01	Thermodynamics	3	0	0	3	40	60
3	P18MET02	Metallurgy & Material Science	3	0	0	3	40	60
4	P18BST03	Mathematics-III	3	0	0	3	40	60
5	P18MET03	Fluid Mechanics & Hydraulic Machines	3	0	0	3	40	60
6	P18MEL01	Computer Aided Machine Drawing	1	0	4	3	40	60
7	P18MEL02	Metallurgy Lab	0	0	3	1.5	40	60
8	P18MEL03	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	1.5	40	60
9	P18MCT03	Professional Ethics and Human Values	2	0	0	-	-	-
Total			17	2	8	22	320	480

II YEAR II SEMESTER								
S.No.	Course Code	Course	L	T	P	Credits	Internal	External
1	P18BST04	Mathematics-IV	3	0	0	3	40	60
2	P18MET04	Production Technology	3	0	0	3	40	60
3	P18MET05	Thermal Engineering –I	3	0	0	3	40	60
4	P18MET06	Mechanics of Solids	3	1	0	4	40	60
5	P18HST03	Managerial Economics & Financial Analysis	3	0	0	3	40	60
6	P18MEL04	Mechanics of Solids Lab	0	0	3	1.5	40	60
7	P18MEL05	Production Technology Lab	0	0	3	1.5	40	60
8	P18MEL06	Thermal Engineering Lab	0	0	3	1.5	40	60
9	P18MCT04	Constitution of India	2	0	0	-	-	-
Total			17	1	9	20.5	320	480

III YEAR I SEMESTER								
S.No.	Course Code	Course	L	T	P	Credits	Internal	External
1	P18MET07	Theory of machines	3	0	0	3	40	60
2	P18MET08	Metal Cutting & Machine Tools	3	0	0	3	40	60
3	P18MET13	Design of Machine Members - I	3	0	0	3	40	60
4	P18MET14	Thermal Engineering –II	3	0	0	3	40	60
5		**Professional Elective – I**	3	0	0	3	40	60
6		**Open Elective - I**	3	0	0	3	40	60
7	P18MEL06	Machine Tools Lab	0	0	3	1.5	40	60
8	P18MEL07	Dynamics of Machinery Lab	0	0	3	1.5	40	60
9	P18MEI01	Internship	0	0	4	2	100	-
10	P18MCT00	Design Thinking	0	0	4	2	100	-
Total			18	0	10	25	520	480

Professional Elective – I		
S.No.	Course Code	Course
1	P18MEE01	Maintenance Engineering
2	P18MEE02	Material Handling
3	P18MEE03	Operations Research
4	P18MEE04	Robotics

S.No.	Course Code	Offered by Dept.	Open Elective – I
1	P18MEO01	MBA	Industrial Engi neering & Management
2	P18MEO02	ECE	MEMS
3	P18MEO03	CSE	Database Management Systems
4	P18MEO04	CSE	Object Oriented Programming through JAVA

III YEAR II SEMESTER								
S.No.	Course Code	Course	L	T	P	Credits	Internal	External
1	P18MET12	Instrumentation & Control Systems	3	0	0	3	40	60
2	P18MET13	Heat and Mass Transfer	3	0	0	3	40	60
3		**Professional Elective – II**	3	0	0	3	40	60
4	P18MET14	Design of Machine Members-II	3	0	0	3	40	60
5	P18MET15	Metrology & Measurements	3	0	0	3	40	60
6	P18MEL09	Metrology & ICS Lab	0	0	3	1.5	40	60
7	P18MEL10	Heat Transfer Lab	0	0	3	1.5	40	60
8	P18MEL11	Mathematical Modelling Lab	0	0	3	1.5	40	60
9	P18MEM01	Mini Project	0	0	0	2	100	0
10	P18MCT06	Biology	2	0	0	-	-	-
Total			17	0	9	21.5	420	480

Professional Elective – II		
S.No.	Course Code	Course
1	P18MEE05	Powder Metallurgy
2	P18MEE06	Automation in Manufacturing
3	P18MEE07	Foundry Technology
4	P18MEE08	Production Planning and Control

IV YEAR I SEMESTER								
S.No.	**CODE**	**COURSE**	**L**	**T**	**P**	**Credit**	**Internal**	**External**
1	P18MET16	CAD /CAM	2	0	0	2	40	60
2	P18MET17	Finite Element Methods	2	1	0	3	40	60
3		**Professional Elective – III**	3	0	0	3	40	60
4	P18MET18	Design of Hydraulics & Pneumatics	3	0	0	3	40	60
5		**Professional Elective – IV**	3	0	0	3	40	60
6	P18MET19	Mechatronics	3	0	0	3	40	60
7	P18MEL12	Simulation Lab	0	0	3	1.5	40	60
8	P18MEL13	Mechatronics Lab	0	0	3	1.5	40	60
9	P19MCT07	Employability Skills	2	0	0	-	-	-
Total Periods			**18**	**1**	**6**	**20**	**320**	**480**

Professional Elective – III		
S.No.	**Course Code**	**Course**
i)	P18MEE09	Non- Destructive Testing &Evaluation
ii)	P18MEE10	Refrigeration & Air Conditioning
iii)	P18MEE11	Mechanical Vibrations
iv)	P18MEE12	Renewable Sources of Energy

Professional Elective – IV		
S.No.	**Course Code**	**Course**
i)	P18MEE13	Additive Manufacturing
ii)	P18MEE14	Nano Technology
iii)	P18MEE15	Power Plant Engineering
iv)	P18MEE16	Tribology

IV YEAR II SEMESTER								
S.No.	**CODE**	**COURSE**	**L**	**T**	**P**	**Credits**	**Internal**	**External**
1	P18MET20	Advanced Automobile Technology	3	0	0	3	40	60
2		**Open Elective – II**	2	0	0	2	40	60
3	P18MEP01	Project Work	0	0	12	6	80	120
Total Periods			**5**	**0**	**12**	**11**	**160**	**240**

S.No.	**Course Code**	**Offered by Dept.**	**Open Elective - II**
1		MBA	IPR& Patents
2		MBA	Entrepreneurship development
3	P18CSO10	CSE	IoT and its Applications
4		H&S	Disaster Management

B.Tech. I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

English-I

(Common to all Branches)

Course Code: P18HST01 **Internal Marks: 40**

External Marks: 60

Course prerequisites: The students should have basic knowledge of English grammar and LSRW skills.

COURSE OBJECTIVES:

- To enable the engineering students to develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course

COURSE OUTCOMES:

On completion of this course, the student is able to:

- Use English Language effectively in spoken and written forms
- Interpret the contextual meaning of words
- Comprehend the given texts and respond appropriately
- Recall and reproduce the theme in a given context
- Communicate confidently in formal and informal contexts

UNIT – I (9 Lectures)

The Happy Prince – Oscar Wilde

a. Vocabulary: Synonyms and Antonyms

(http://www.magickeys.com/books/riddles/words.html)

b. Grammar: Prepositions, Sentence structure & Types of sentences

c. Writing: Note Making and Note Taking

UNIT – II (8 Lectures)

Technology With a Human Face – E.F.Schumacher

a. Vocabulary: One word substitutes & Idioms

b. Grammar: Subject–verb Agreement (Concord), Question tags and Modal Auxiliaries

c. Writing: Information Transfer

UNIT –III (9 Lectures)

Presidential Address – APJ Abdul Kalam

a. Vocabulary: Word formation, Root Words

(www.englishhints.com,www.enchantedlearning.com,

www.learnenglish.de/grammar/prefixtext.html)

b. Grammar: Parts of Speech and Punctuation

c. Writing: Paragraph Writing

UNIT- IV (9 Lectures)

The Road Not Taken – Robert Frost

a. Vocabulary: Prefixes, Suffixes and Affixes

(http://www.magickeys.com/books/riddles/words.html)

b. Grammar: Articles

c. Writing: Letter Writing

UNIT – V (10 Lectures)

Good Manners – J.C Hill

a. Vocabulary: Homonyms, Homophones and Homographs

(http://www.pinnacle.edu.in/campusfiles/1826_campusFile_1.pdf)

b. Grammar: Tenses

c. Writing: E- mail Writing

Textbooks:

1. New Horizons – Pearson Publishers
2. Fluency in English", A Course Book for Engg. Students, Published by Orient Black Swan, Hyderabad, 2016 print.
3. "Technical Communication- Principles and Practice", Third Edition. New Delhi: Oxford University press.

References:

1. Meenakshi raman, Sangeetha, Sharma Fundamentals of technical communication, Pg: 119-153 Oxford University press, 2015
2. Rutherford, Andhrea. J, Communication skills for technology. Pearson, New Delhi.2001
3. Raymond Murphy, Murphy's English Grammar, Cambridge University Press 2004
4. Meenakshi raman, Sangeetha, Sharma,Technical communication: English Skills for Engineers, Oxford University press, 2009
5. Michael Swan, Practical English Usage, Oxford University press, 1996

Online Resources:

1. (www.englishhints.com,www.enchantedlearning.com, www.learnenglish.de/grammar/prefixtext.html)
2. (http://www.magickeys.com/books/riddles/words.html)
3. (http://www.pinnacle.edu.in/campusfiles/1826_campusFile_1.pdf)
4. http://www.yourdictionary.com
5. http://www.learnenglish.com
6. http://www.cambridge.org
7. http://www.eslcafe.com
8. http://www.eslgames.com
9. http://www.penguin.co.uk
10. http://www.edufind.com/english/practice

B. Tech- I Year I Semester **Course structure**

L	T	P	C
3	0	0	3

MATHEMATICS-I

(Differential equations and Laplace transforms)

(Common to All Branches)

Internal Marks: 40

Course code: P18BST01 **External marks: 60**

Course Prerequisite: The basic knowledge of Matrices, Trigonometry, Differentiation and Integration.

Course Objectives:

- To learn the methods solving the differential equations of first order with their Applications.
- To learn the methods of solving differential equations of second and higher order with Their applications.
- To learn to find the Laplace transform of different functions and obtained the solution of Design.
- To understand the concepts Partial Differential.

Course Outcomes: After learning the contents of this paper the student must be able to

- Solve first order differential equations and their applications.
- Usage of higher order differential equations that are applied to real world problems.
- Find the Laplace transform of derivatives, integrals and periodic functions.
- Use the method of Laplace transforms to solve systems of linear first-order differential Equations.
- Calculate total derivative, Jacobean, Maxima and minima of functions of two variables.

UNIT-I: Differential equations of first order and first degree:

Linear-Bernoulli-Exact-Reducible to exact.

Applications: Newton's Law of cooling-Law of natural growth and decay- Orthogonal trajectories.

UNIT-II: Linear differential equations of higher order:

Non-homogeneous equations of 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)- Method of Variation of parameters.

Applications: LCR circuit.

UNIT-III: Laplace Transforms:

Laplace transforms of standard functions– First shifting Theorem, Change of scale property, Multiplication by t^n, division by t, Transforms of derivatives and integrals – Second shifting theorem– Laplace transform of Periodic functions.

UNIT IV: Inverse Laplace Transforms:

Inverse Laplace transforms – Convolution theorem.

Application of Laplace transforms to ordinary differential equations of first and second order.

UNITV: Partial Differentiation:

Introduction- Homogeneous function-Euler's theorem-Total derivative-Chain rule-Generalized Mean value theorem for single variable (without proof)-Taylor's and Mc Laurent's series expansion of functions of two variables– Functional dependence- Jacobian.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. N.P.Bali, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
4. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
5. Srimanta Pal, Subodh C.Bhunia, Engineering Mathematics, Oxford University Press.
6. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

Web Resources:

1. http://tutorial.math.lamar.edu/Classes/DE/DE.aspx
2. http://mathworld.wolfram.com/topics
3. http://www.nptel.ac.in/course.php

B.Tech I Year I Semester **Course Structure**

	L	T	P	C
ENGINEERING CHEMISTRY	**3**	**1**	**0**	**4**

(Common to CE, ME, AME)

Course Code: P18BST06 **Internal Marks: 40**

External Marks: 60

Course Prerequisite: Basic Chemistry at Intermediate or equivalent level.

Course Objectives:

- Atomic and molecular structure is the basic concept to understand the structure of different complex molecules.
- Fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
- The basics for the construction of galvanic cells are introduced. Also if corrosion is to be controlled, one has to understand the mechanism of corrosion which itself is explained by electrochemical theory.
- Water is a basic material in almost all the industries, more so where steam is generated and also where it is supplied for drinking purposes.
- Spectroscopic techniques are a basic need of any analytical industry to analyze chemical compound.

Course Outcomes: After completion of course student will be able to

- **CO1:** To understand the color and magnetic properties of the metal complexes.
- **CO2:** Fuels which are used commonly and their economics, advantages and limitations
- **CO3:** Analyze the different types of electrodes and batteries for technological applications.
- **CO4:** Identify the troubles due to hardness of water and its maintenance in industrial applications
- **CO5:** Analyze the structure of the chemical compounds.

UNIT I: ATOMIC AND MOLECULAR STRUCTURE (12 Lectures)

Atomic and Molecular orbitals**.** Linear Combination of Atomic Orbital (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N2, O2 and F2 molecules. Π molecular orbitals of butadiene and benzene.

Crystal Field Theory (CFT)**,** salient features of CFT-Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids.

UNIT II – CHEMISTRY OF COMBUSTION (10 Lectures)

Fuel: classification of fuels- calorific value- higher and lower calorific values.

Liquid fuels: Petroleum- manufacture of synthetic petrol (Bergius process) - knocking- octane number - diesel oil- cetane number.

Gaseous fuels: Combustion of fuels: Introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- flue gas analysis by Orsat's apparatus. Problems on combustion.

UNIT III: ELECTROCHEMISTRY AND CORROSION (11 Lectures)

Introduction, Single electrode potential**,** EMF, Galvanic cell, Nernst equation and applications. Reference Electrodes - SHE, calomel electrode. Electro chemical series and uses of this series, Concentration cells

Batteries: Introduction, reversible and irreversible cells, Dry Cell, Ni - Cd Cells, Pb-acid storage cells, Li ion cells.

Corrosion: causes, Theories of Corrosion (chemical and Electro chemical), types- galvanic, differential aeration, stress corrosion, corrosion control methods– material selection and designing aspects - Cathode protection – sacrificial anodic protection and impressed current cathode. Galvanizing, Tinning, Electroplating of Copper and electro less plating of nickel.

UNIT IV: WATER CHEMISTRY (12 Lectures)

Introduction: Source of water and quality.

Hardness: Reasons for hardness -units of hardness - Water for drinking purposes- Purification – Sterilization and disinfection: Chlorination, Break point chlorination.

Boiler troubles: Reasons, Priming and Foaming, Scale &Sludge formation, Boiler corrosion, Caustic embrittlement - Internal treatments.

Softening of Hard water: Zeolite process, Ion Exchange processes.

Desalination of Brackish water: Reverse Osmosis and Electro Dialysis.

UNIT-V: SPECTROSCOPIC TECHNIQUES AND ORGANIC SYNTHESIS OF DRUG MOLECULE (10 Lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance spectroscopy, chemical shift. Introduction to Magnetic resonance imaging.

Synthesis of commonly used drug molecules- Ibuoprofen, Aspirin, Paracetmol

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication& Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press.
3. Physical chemistry by K.Bahl and Tuli
4. Elementary organic spectroscopy by Y.R. Sharma ,S.Chand publications
5. Spectroscopic techniques by H.Kaur. Pragati Prakashan publications

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others.
2. Engineering Chemistry by Prasanth Rath, Cengage Learning.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others.

WEB REFERENCES:

1. http://jntuk-coeerd.in/
2. http://en.wikipedia.org/wiki/title
3. http://nptel.ac.in/coures/105106/.com
4. https://en.wikipedia.org/wiki/Electrochemistry
5. https://www.youtube.com/watch?v=WLyaZbT97EI&list=PLzW3I18TEXrpqo3jRarGr9ao-61tB2184
6. http://encyclopedia.che.engin.umich.edu/Pages/Polymers/PolymerProduction/PolymerProduction.html
7. http://encyclopedia.che.engin.umich.edu/Pages/ProcessParameters/Spectrometers/Spectrometers.html

B.Tech. I Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to all Branches)

Internal Marks: 40

Course Code: P18EST01 **External Marks: 60**

Course Prerequisite: Physics.

COURSE OBJECTIVE:

1. To study the concepts of passive elements, and understand the applications of network theorems for analysis of electrical networks.
2. To study the concept of magnetic coupled circuit.
3. To understand the Principle and operation of Various Electrical Machines.
4. To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
5. To learn the operation of PNP, NPN transistors and various amplifiers.

COURSE OUTCOMES:

After completion of this course, the student is able to:

1. Able to solve various electrical networks in presence of active and passive elements and by using principles of network theorems.
2. Able to solve magnetic circuit with various dot conventions.
3. Able to understand the principle of operation and construction details of DC machines, Transformers, Alternators,3-phase Induction motor.
4. Able to analyze the operation of half wave, full wave bridge rectifiers and OP-AMPs.
5. Able to analyze operation of PNP, NPN transistors and CE amplifiers

UNIT – I- ELECTRICAL CIRCUITS (12 Lectures)

Basic definitions – Types of network elements- Types of sources - Ohm's Law - Kirchhoff's Laws –Inductive networks - Capacitive networks – Series - Parallel circuits- Star-delta and delta-star transformations - Source transformation - nodal analysis and mesh analysis - Super position theorem.

UNIT – II -AC CIRCUIT ANALYSIS (12 Lectures)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R,L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT –III- MAGNETIC CIRCUITS AND TRANSFORMERS (12 Lectures)

Basic definition of Magnetic quantities - Faraday's laws of electromagnetic induction- Analogy between electrical and magnetic circuits. Concept of self and mutual inductance. Principle of operation and construction of single phase transformers–EMF equation – Applications.

UNIT- IV- ROTATING MACHINES (10 Lectures)

Construction and Principle of operation of DC Machines EMF equation – Torque equation –Speed control of DC Shunt Motor- power losses and efficiency - Principle of operation and construction of 3-phase Induction motor - Principle of operation and construction of alternators.

UNIT – V- INTRODUCTION TO SEMICONDUCTOR DEVICES (10 Lectures)

PN junction diode - Diode applications -Half wave -Full wave rectifiers – Characteristics of Operational Amplifiers - Types of Transistors - PNP and NPN junction transistors, transistor as an amplifier- Frequency response of CE Amplifier.

TEXTBOOKS:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, McGraw Hill Company,6 th Edition
2. Electrical Technology by Surinder Pal Bali, Pearson Publications.
3. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th Edition, PEI/PHI 2006.
4. Electronic Devices and Circuits – J. Millman, C.C. Halkias, Tata Mc-Graw Hill

REFERENCES:

1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
2. Electrical Machines by D. P.Kothari, I .J .Nagarth, Mc Graw Hill Publications, 4th Edition
3. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th Edition.
4. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
5. Electronic Devices and Circuits by David A. Bell, Oxford University Press
6. Electronic Devices and Circuits – Salivahanan, Kumar, Vallavaraj, TATA MC Graw Hill, Second Edition

WEB REFERENCES:

1. https://embeddedengineers.files.wordpress.com/2015/09/electronic-devices-and-circuits-by-salivahanan.pdf
2. https://electricalanswers.files.wordpress.com/2014/09/a-textbook-of-electrical-technology-volume-i-basic-electrical-engineering-b-l-theraja.pdf

B.Tech I Year - I Semester

L	T	P	C
3	0	0	3

C - Programming for Problem Solving
(Common to all Branches)

Course Code: P18EST03 **Internal Marks: 40**

External Marks: 60

Course Objectives:

1. To impart adequate knowledge on the need of programming languages and problem solving techniques.
2. To impart problem solving skills.
3. To enable student to write programs in C and to solve the problems.

Course Outcomes:

At the end of this course the student will be able to

1. Design algorithms and flowchart / Pseudo code for a given problem.
2. Design programs involving decision structures and loops.
3. Implement different operations on arrays and solve problems using functions.
4. Understand pointers and strings.
5. Implement structures, unions and file operations in C programming for a given application problem.

Unit-I:- Introduction to Programming: **(8 Lectures)**

Computer hardware, Bits and Bytes, programming languages, application and system software, the software development process.

Idea of algorithm: steps to solve logical and numerical problems. Representation of algorithm: flowchart/pseudo code with examples, from algorithms to programs.

Unit-II:- Introduction to C **(9 Lectures)**

: Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing Input and Output. Decision Making - Branching and Looping. Enumerated Data type, Renaming Data type with typedef, Type Casting.

UNIT-III- Arrays: **(12 Lectures)**

Definition, Declaration, Initialization, Assignment, Processing array, Passing array to a function, Two and multi-dimensional array.

Functions: Defining a function, Accessing a function, Passing argument to functions, Function prototypes, Nested function call, Storage classes.

UNIT-IV- Pointers: **(10 Lectures)**

Definition, initialization, operations on pointers, functions and pointers, arrays and pointers, pointers to pointers, dynamic memory allocation.

Strings: C Strings, String Input / Output functions, arrays of strings, string manipulation functions.

UNIT-V- Structures: **(9 Lectures)**

Definition, declaration, initialization, accessing members, array of structures, arrays within structure, functions and structures, pointers to structures, nested structures, unions.

File Handling: Types, operations on files, modes, file I/O functions, Random Access Functions.

Text Books:

1. Byron S Gottfried, ―Programming with C, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Problem Solving and Program Design in C, 4th edition, by jeri R. Hanly and Elli B.Koffman.
3. Balagurusamy. 2011. C Programming. Tata Mc Graw Hills, New Delhi, India.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India. Yashavant P. Kanetkar. ―Let Us C, BPB Publications, 2011.

B.Tech. I Year I Semester **Course Structure**

	L	T	P	C
English Language Communication Skills Lab	**3**	**0**	**0**	**1.5**

(Common to all Branches)

Internal Marks: 40

Course Code: P18HSL01 **External Marks: 60**

Course Prerequisite:

- Basic knowledge of English grammar.
- Basic understanding of English vocabulary.
- Ability to speak simple sentences.
- Have interest to learn the language.

Course Objectives

- To facilitate computer assisted multimedia instructions enabling individualized and independent language learning.
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
- To bring about a consistence accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency of students in spoken English and neutralize their mother tongue influence.
- To train students to use language appropriately for public speaking, group discussion and interviews.

Course Outcomes

- Better understanding of nuances of English language through audio visual experience and group activities.
- Neutralization of accent for intelligibility.
- Speaking skills with clarity and confidence which in turn enhances their employability skills.
- Better understanding of the production of sounds of language.
- Suitable body language for employability.

Scope:

The curriculum of the **ELCS Lab** is designed to focus on the production and practice of sounds of language and to familiarize the students with the use of English in everyday situations and contexts.

EXERCISE – I **(3 Sessions)**

- **A.** Ice – Breaking Activity, Greeting, Introducing and taking leave
- **B.** Introduction to Phonetics

  Vowel sounds – Pure Vowels & Diphthongs

  Consonant sounds

EXERCISE – II **(2 Sessions)**

- **A.** JAM Session, Situational Dialogues, Giving Directions & Narration
- **B.** Structure of Syllables - Plural markers & Past tense Markers

EXERCISE – III **(2 Sessions)**

- **A.** Role play, Giving Information and Asking Information
- **B.** Word Stress & Listening Comprehension – Listening for General Details

EXERCISE – IV **(2 Sessions)**

- **A.** Describing objects, events, places etc. & Presentation Skills – Extempore, Public

  Speaking.
- **B.** Consonant Cluster, Rules of 'r' pronunciation and Neutralization of Mother

  Tongue Influence

EXERCISE – V **(3 Sessions)**

- **A.** Interview Skills & Group Discussion
- **B.** Intonation & Listening Comprehension – Listening for Specific Details

Textbooks:

1. Strengthen your Communication Skills - Maruthi Publication, Hyderabad 2013

2. A textbook of English Phonetics for Indian Students by T. Balasubramanian(Macmillan)

References:

- INFOTECH English (Maruthi Publications).
- Personality Development and Soft Skills (Oxford University Press, New Delhi)
- Suresh Kumar, E. & Sreehari, P. 2009. A Handbook for English Language Laboratories. New Delhi: Foundation
- Speaking English Effectively 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
- Sasi Kumar, V & Dhamija, P.V. How to Prepare for Group Discussion and Interviews. Tata McGraw Hill
- Hancock, M. 2009. English Pronunciation in Use. Intermediate. Cambridge: CUP

- Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad
- Hewings, M. 2009. English Pronunciation in Use. Advanced. Cambridge: CUP
- Marks, J. 2009. English Pronunciation in Use. Elementary. Cambridge: CUP
- Nambiar, K.C. 2011. Speaking Accurately. A Course in International Communication. New Delhi : Foundation
- Soundararaj, Francis. 2012. Basics of Communication in English. New Delhi: Macmillan
- Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
- English Pronouncing Dictionary Daniel Jones Current Edition with CD.

Online Resources:

- http://www.cambridge.org
- http://www.edufind.com/english/practice
- http://www.learnenglish.com
- http://www.penguin.co.uk

B.Tech I Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

ENGINEERING/APPLIED CHEMISTRY LAB

Internal Marks: 40

Course Code: P18BSL03 **External Marks: 60**

Course Prerequisite: Basic Chemistry at Intermediate or equivalent level.

Course Objectives:

The purpose of this course to provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

Course Outcomes:

After completion of this course, the students should be able to

- Carrying out different types of titrations for estimation of concerned in materials using comparatively more quantities of materials involved for good results.
- Handling different types of instruments for analysis of materials using small quantities of materials involved for quick and accurate results.

LIST OF EXPERIMENTS:

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Qualitative analysis etc.

VOLUMETRIC ANALYSIS:

1. Estimation of Na_2CO_3 using standard HCl solution
2. Estimation of Mohr's salt using potassium dichromate ($K_2Cr_2O_7$) solution
3. Estimation of $CuSO_4$ using sodium thio sulphate ($Na_2S_2O_3$) solution.

WATER ANALYSIS:

4. Determination of hardness of water sample by EDTA method
5. Determination of alkalinity of water sample
6. Determination of free chlorine in bleaching powder

INSTRUMENTAL TITRATIONS:

7. Conduct metric Titrations between strong acid and strong base.
8. Conduct metric Titrations between strong acid and weak base.
9. Potentio metric Titration between Ferrous iron and potassium dichromate ($K_2Cr_2O_7$) solution

FOOD ANALYSIS & SEPARATION OF COMPOUNDS:

10. Estimation of Vitamin-c
11. Thin layer chromatography

PREPARATION OF POLYMERIC RESIN:

12. Preparation of phenol formaldehyde resin
13. Preparation of urea formaldehyde resin

Lab Manual: Engineering/Applied Chemistry Lab Manual, Dept. of Chemistry, Pace Institute of Technology and Science, Vallur, Prakasam Dist., Andhra Pradesh, India.

REFERENCE BOOKS:

1. Dr. Jyotsna Cherukuris (2012) Laboratory Manual of engineering chemistry-II,
2. VGS Techno Series 3. Chemistry Practical Manual, Lorven Publications

B.Tech. I Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

(Common to all Branches)

Course Code: P18ESL01 **Internal Marks: 40**

Course Prerequisite: None **External Marks: 60**

COURSE OBJECTIVE:

1. To verify and demonstrate on safety precautions and Kirchhoff laws.
2. To demonstrate various protective devices and construction of transformer and rotating machines.
3. To verify superposition theorem and control of dc shunt motor using speed control methods.
4. To analyze the characteristics of PN junction diode & transistor
5. To analyze the characteristics of CE amplifier and Half & Full wave rectifiers.
6. To analyze the characteristics of OP –Amp and CE amplifier

COURSE OUTCOMES:

After completion of this course, the student is able to:

1. Get an exposure on safety precautions and verify Kirchhoff laws.
2. Get an exposure on construction of transformer and various protective devices.
3. Verify superposition theorem and control the speed of DC shunt motor using speed control methods.
4. Analyze the characteristics of CE amplifier and Half & Full wave rectifiers.
5. Analyze the characteristics of OP –Amp and CE amplifier

Any Ten from the following experiments are required to be conducted as compulsory experiments:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Verification of Kirchhoff laws.
3. Demonstration of construction of Transformer and Rotating machines.
4. Demonstration on various protective devices.
5. Verification of superposition theorem
6. Speed control of D.C. Shunt motor by
    a) Armature Voltage control b) Field flux control method
7. PN junction diode characteristics
    a. Forward bias
    b. Reverse bias (Cut in voltage and resistance calculations)
8. Transistor CE characteristics (Input and output)
9. CE Amplifier Characteristics
10. Half Wave rectifier and Full Wave Rectifier without filters
11. Frequency Response of CE Amplifier.
12. Op-Amp Characteristics

B.Tech. I Year I Semester **L T P C**

0 0 3 1.5

C - Programming for Problem Solving Lab
(Common to all Branches)

Course Code: **P18ESL03** **Internal Marks: 40**

Course Prerequisite: None **External Marks: 60**

Course Objectives:

1. To understand the various steps in program development.

2. To understand the basic concepts in C Programming Language.

3. To understand different modules that includes conditional and looping expressions.

4. To understand how to write modular and readable C Programs.

5. To write programs in C to solve problems using arrays, structures and files.

EXPERIMENT WISE PROGRAMS

Experiment-1

a) Write a simple C program to Print "Hello World"
b) Write a simple C Program to Calculate Area and Circumference of Circle
c) Write a simple C program to implement basic arithmetic operations - sum, difference, product, quotient and remainder of given numbers.

Experiment-2

Write C programs to demonstrate the following operators

a) Assignment Operator.
b) Relational and Logical Operator.
c) Increment and decrement operator.
d) Bitwise operators.
e) Ternary operator.

Experiment-3

a) Write a C programs - to find the largest and smallest of 2 numbers(if – else), to find the largest and smallest of 3 numbers(Nested if – else), roots of quadratic equation(else – if ladder).
b) The total distance travelled by vehicle in't' seconds is given by distance=ut+1/2at2 where 'u' and 'a' are the initial velocity and acceleration.
Write a c program to find the distance travelled at regular intervals of time given the Values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

c) Write a c program, which takes two integer operands and one operator from the user, performs the operation and the prints the result. (consider the operators +,-,*,/,% and use switch statement).

Experiment-4

a) Write a C program to find the sum of individual digits of a positive integer
b) A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1.Subsequent terms are found by adding the preceding two terms in the sequence .Write a c program to generate the first n terms of the sequence.
c) Write a c program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Experiment-5

a) Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:
$1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$.

b) Write a C program to generate Pascal's triangle.
c) Write a C program to construct a pyramid of numbers

Experiment-6

a) Write a c program to find both the largest and smallest number in a list of integers.
b) Write a c program that uses functions to perform the following:
    i) Addition of Two Matrices.
    ii) Multiplication of Two Matrices.

Experiment-7

a) Write a programs that use both recursive and non-recursive functions
b) To find the factorial of a given integer.
c) To find the GCD of two given integers.

Experiment-8

a) Write a c program that uses functions to perform the following operations:
    i) To insert a sub-string in given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
b) Write a C program to determine if the given string is a palindrome or not.

Experiment-9

a) Write a C program that displays the position or index in the string S Where the string T begins, or - 1 if S doesn't contain T.
b) Write a C program to count the lines, words and characters in a given text .

Experiment-10

a) Write a program to print the details of a student like(Name, Rollno, marks) using nested structures.
b) Write a C Program to Calculate Difference Between Two Time Period.

Experiment-11

a) Write a C program that uses functions to perform the following operations:
   i) Reading a complex number
   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Multiplication of two complex numbers
   (Note: represent complex number using a structure.)

Experiment-12

a) Write a C program which copies one file to another and display the contents of a file
b) Write a C program to reverse the first n characters in a file.
c) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

B.Tech. I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

English-II

(Common to all Branches)

Internal Marks: 40

Course Code: P18HST02 **External Marks: 60**

Course prerequisites: The students should have basic knowledge of English grammar and LSRW skills.

COURSE OBJECTIVES:

- To enable the engineering students to develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course

COURSE OUTCOMES:

On completion of this course, the student is able to:

- Use English Language effectively in spoken and written forms
- Interpret the contextual meaning of words
- Comprehend the given texts and respond appropriately
- Recall and reproduce the theme in a given context
- Communicate confidently in formal and informal contexts

UNIT – I (8 Lectures)

My Struggle for an Education – Booker T. Washington

a. Vocabulary: Collocations

b. Grammar: Finite verbs, Non- finite verbs, Gerund, Transitive and Intransitive Verbs

c. Writing: Precis Writing

UNIT – II (9 Lectures)

In London – M.K.Gandhi

a. Vocabulary: Commonly confused words

b. Grammar: Active voice and Passive voice

c. Writing: Technical Report Writing

UNIT –III (10 Lectures)

Principles of Good Writing – L A Hill

a. Vocabulary: Commonly Misspelt Words

b. Grammar: Direct & Indirect Speech

c. Writing: Essay Writing

UNIT- IV (9 Lectures)

The Secret of Work – Swami Vivekanada

a. Vocabulary: Technical vocabulary

b. Grammar: Degrees of Comparison

c. Writing: Curriculum vitae, Cover Letter and Resume Writing. (Functional, Chronological and standard Resumes)

UNIT – V (9 Lectures)

Oh Father Dear Father – Raj Kinger

a. Vocabulary: Phrasal verbs

b. Grammar: Simple, Compound and Complex Sentences

c. Writing: Hints Development

Textbooks:

1. Board of Editors, "Sure Outcomes"– Orient Blackswan, Hyderabad, 2013
2. "Panorama" – Oxford University Press, New Delhi, 2016
3. "Fluency in English", A Course Book for Engg. Students, Published by Orient Black Swan, Hyderabad, 2016 print.
4. "Technical Communication- Principles and Practice", Third Edition. New Delhi: Oxford University press.

References:

1. Murphy, "English Grammar with CD", Cambridge University Press, New Delhi, 2004.
2. Rizvi Asheaf M, "Effective Technical Communication", Tata McGraw Hill, New Delhi, 2008
3. Baradwaj Kumkum, Professional Communication", I.K. International-Principles and Practice". Third Edition. New Delhi: Oxford University Press.2015
4. Trailblazers – Board of Editors – Orient Blackswan New Delhi.

Online Resources:

1. (www.englishhints.com,www.enchantedlearning.com, www.learnenglish.de/grammar/prefixtext.html)
2. (http://www.magickeys.com/books/riddles/words.html)
3. (http://www.pinnacle.edu.in/campusfiles/1826_campusFile_1.pdf)
4. http://www.yourdictionary.com
5. http://www.learnenglish.com
6. http://www.cambridge.org
7. http://www.eslcafe.com
8. http://www.eslgames.com
9. http://www.penguin.co.uk
10. http://www.edufind.com/english/practice

B.Tech. I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

MATHEMATICS-II

(**Linear algebra and Vector calculus**)

(Common to All Branches)

Internal Marks: 40

Course Code: P18BST02 **External Marks: 60**

Course Prerequisite: **Mathematics-II (P18BST02)**

Course Objectives: To learn

1. The subject gives the knowledge about matrices and applications to solve linear equations.
2. The course intends to provide an overview of Eigen values and Eigen vectors which occur in Physical and engineering problems.
3. To integration over the regions.
4. The concepts of vector differentiation.
5. Line integral, Surface and volume integrals, Vector integral theorems.

Course Outcomes:

After learning the contents of this paper the student must be able to

1. Apply this knowledge to solve linear equations.
2. Eigen values and Eigen vectors of a given matrix and solve simultaneous linear equations.
3. Determine double integral over a region and triple integral over a volume.
4. Analyze the Vector differentiation in various domains.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

UNIT I:- Linear systems of equations: **(10 Lectures)**

Rank-Echelon form-Normal form – Solution of linear systems – Gauss elimination – Gauss Jordon- Gauss Jacobi and Gauss Seidal methods.

Applications: Finding the current in electrical circuits.

UNIT II:- Eigen values - Eigen vectors and Quadratic forms: **(10 Lectures)**

Eigen values - Eigen vectors– Properties – Cayley-Hamilton theorem - Inverse and powers of a matrix by using Cayley-Hamilton theorem- Diagonalization- Quadratic forms-Reduction of quadratic form to canonical form – Rank - Positive, negative and semi definite - Index – Signature.

UNIT III:- Multiple integrals: **(9 Lectures)**

Double and triple integrals – Change of variables – Change of order of integration. Applications: Finding Areas, surface areas and Volumes.

UNIT IV:- Vector Differentiation: (10 Lectures)

Gradient-Directional derivative, Divergence- Solenoidal vector, Curl –Irrotational Vector, Vector identities.Applications: Equation of continuity, potential surfaces.

UNIT V:- Vector Integration: (9 Lectures)

Line integral – Work done – Potential function – Area- Surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems.

Applications: Work done, Force.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. N.P.Bali, Engineering Mathematics, Lakshmi Publications.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
4. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
5. Srimanta Pal, Subodh C.Bhunia, Engineering Mathematics, Oxford University Press.
6. Dass H.K., Rajnish Verma. Er., Higher Engineering Mathematics, S. Chand Co. Pvt. Ltd, Delhi.

Web References:

1. http://tutorial.math.lamar.edu/Classes/DE/DE.aspx
2. http://mathworld.wolfram.com/topics
3. http://www.nptel.ac.in/course.php

B.Tech. I Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

ENGINEERING PHYSICS
(Common to CE, ME & AME)

Internal Marks: 40

Course code: P18BST04 **External Marks: 60**

Course Prerequisites: The basics of analytical and conceptual understanding of physics.

Course Objectives

1. To impart the concepts of wave optics.
2. Learn the concepts of Polarization and Lasers.
3. To study the solid state physics through Crystallography and X-ray diffraction.
4. To explore the knowledge of Oscillations and vibrations in engineering fields.
5. To learn the basic concepts in Acoustics, Magnetism and Dielectrics.

Course Outcomes:

1. Understand the basic concepts in optics and apply for engineeringapplications.
2. Gain knowledge of Lasers and enable the students to develop Laser devices toapply the knowledge various systems like Industries and medicine.
3. Enable to apply the concept of crystal structure and x-ray diffraction for newmaterials.
4. Understand the basic concepts oscillations and vibrations to apply inEngineering fields
5. Acquire the knowledge of Acoustics, Magnetism and Dielectrics.

UNIT-I : Wave Optics (10 lectures)

Interference: Introduction, Superposition of waves, Interference of light by wave front splitting and amplitude splitting, interference in thin films, Newton's rings.

Diffraction: Introduction, differences between interference and diffraction, difference between Fraunhoffer and Fresnel diffraction, Fraunhoffer diffraction at single slit, Diffraction grating (N-slits qualitative), diffraction at circular aperture, resolving power of microscope, and telescope.

UNIT-II:- Polarization And Lasers (10 lectures)

Polarization: Introduction, types of polarization, methods of production, working principle of polarimeter.

Lasers: Introduction, Characteristics of laser, Absorption, spontaneous emission, stimulated emission, Principle Laser, Einstein's coefficients, Population inversion, Pumping, Types of Lasers: Ruby laser, He-Ne laser, Applications of laser.

UNIT-III:- CRYSTALLOGRAPHY AND X-RAY DIFFRACTION (8 Lectures)

Crystallography: Introduction, Space lattice, Basis, Crystal structure, Lattice

parameters, Unit cell, crystal systems and Bravais lattices, structures and packing fraction of SC, BCC, and FCC, Lattice constant.X-**ray diffraction**: Introduction, Miller Indices, Important features of Miller indices, separation between successive crystal planes, Bragg's law.

UNIT – IV:- Oscillations And Vibrations (10 lectures) Harmonic oscillations: Introduction, simple harmonic motion, the simple oscillator, equation of motion of a simple oscillator, characteristics, energy of simple harmonic oscillator, damped harmonic oscillator, heavy, critical and light damping, waves(longitudinal, transverse and standing waves)

Transverse vibrations of stretched strings: Velocity of transverse wave along stretched string, Frequency of vibrating string, Harmonics and overtones.

UNIT – V:- Acoustics, Magnetism And Dielectrics (10 lectures)

Acoustics: Introduction, sound absorption coefficient, reverberation, reverberationtime, Sabine's formula for reverberation time, conditions for good auditorium.

Magnetism and Dielectrics: Classification of magnetic materials, Ferromagnetism, Hysteresis, Electric polarization, Dielectrics in AC and DC fields, internal field, Clausius-Mossoti equation.

Text Books:

1. Engineering physics by M. N. Avadhanulu and P.G.Kshirsagar, S.Chand,New Delhi.
2. Optics by Ajoy Ghatak, McGraw Hill Education.
3. Principle of Lasers by O. Svelto
4. Solid state physics by AJ Dekker.
5. Vibrations and waves in physics by Ian G. Main, 3rd Edn, CambridgeUniversity Press,
6. Engineering physics by D. K. Bhattacharya and Poonam Tandon, OxfordPress

Reference Books:

1. Optics by E.Hecht.
2. The physics of vibrations and waves by H.J. Pain, John Wiley & Sons, Ltd
3. Introduction to Mechanics by M. K. Verma, Universities Press.
4. Engineering physics by Palanisamy (scitech publications).
5. Engineering Physics by RK GAUR & SL GUPTA, DhanpatRaiPublication
6. Physics by Halliday and Resnick.
7. Physics for Engineers by M. R. Srinasan, New age Internationalpublishers

Web References:

1. http://jntuk-coeerd.in/
2. http://www.youtube.com
3. http://en.wikipedia.org
4. http://nptel.ac.in/syllabus/122106027/

B.Tech I Year - II Semester

Course Structure

L	T	P	C
3	0	0	3

PYTHON PROGRAMMING
(Common to ALL Branches)

Course Code: P18EST04 **Internal Marks: 40**

External Marks: 60

Course Objectives:

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and apply OOP concept.
4. To use Python data structures –- lists, tuples, dictionaries.
5. To develop GUI applications in Python.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the basics of python programming.
2. Understand control flow and implement various data structures provided by python.
3. Implement packages, methods and functions.
4. Develop real-world applications using oops and exception handling.
5. Build GUI Applications in Python.

UNIT-I:- Introduction **(9 Lectures)**

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT-II: Types, Operators and Expressions **(10 Lectures)**

Types - Integers, Strings, Booleans, Expressions and order of evaluations, Control Flow- if, if-elif-else, for, while, break, continue, pass.

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions.

UNIT III: Functions (11 Lectures)

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from. Import statement, name spacing,
Python packages: Introduction to PIP, Installing Packages via PIP, Using Python Packages

UNIT IV: Object Oriented Programming OOP in Python (9 Lectures)
Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.
Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.

UNIT V : Brief Tour of the Standard Library & Files (9 Lectures)
- Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics, file operations.

Text Books

1. 1.Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/).
2. 2.Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Books

1. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
2. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.

B.Tech I Year - II Semester **Course Structure**

ENGINEERING GRAPHICS	**L**	**T**	**P**	**C**
(Common to all branches)	**1**	**0**	**3**	**2.5**

Internal Marks: 40

Course Code: P18EST02 **External Marks: 60**

Course objectives:

1. To introduce the students to the "universal language of Engineers" for effective communication through drafting exercises.
2. To enable the students to acquire requisite knowledge, techniques and attitude required for advanced study of engineering drawing.
3. To enable the students to construct the layout development of basic solids for practical situations.
4. To enable the students to gain the ability to convert the Isometric views in to Orthographic views.
5. To enable the students to gain the ability to convert the Orthographic views in to Isometric views.

Course Outcomes:

After completion of the course the student will be able to

1. Gain the knowledge of various Geometrical Elements used in Engineering Practice.
2. Understand concepts of all 2 D elements like polygons, Conic Sections.
3. Understand concepts of 3 D Objects like various Prisms, Cylinders, Pyramids and Cones.
4. Draw and represent the Projections of various objects.
5. Convert the 3 D views in to 2 D views and vice versa.

UNIT-I: INTRODUCTION TO ENGINEERING GRAPHICS (15 Lectures)

Introduction to Drawing instruments and their uses, construction of regular polygons, Conic sections- ellipse, parabola, hyperbola using general method, Scales- Diagonal scale, Vernier scale.

UNIT-II: PROJECTIONS OF POINTS & LINES (12 Lectures)

Principle of orthographic projection-Method of Projection – First and third angle projection methods- Projections of Points –Projection of straight lines- parallel to one plane and inclined to the other plane.

UNIT-III: PROJECTIONS OF LINES & PLANES (18 Lectures)

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclinations and traces. Projections of Planes: Projections of plane figures: triangle, square, rectangle, pentagon and hexagon, circle with surfaces inclined to both the reference planes.

UNIT-IV: PROJECTIONS OF SOLIDS & SURFACE DEVELOPMENT (15 Lectures)

Projections of Solids: Projections of regular solids with the axis inclined to only one reference plane. Development of surfaces for basic solids- prisms, pyramids, cylinder and cone.

UNIT – V: PROJECTIONS OF PICTORIAL VIEWS (15 Lectures)

Conversion of isometric views into orthographic views and conversion of orthographic views in to isometric views.

Text Book:

1. Engineering Drawing by N.D. Bhatt & V.M. Panchal, Charotar Publications, 2014.
2. Engineering Drawing by Basant Agrawal and C.M. Agrawal ,McGraw Hill Education Pvt. Limited, 2013.
3. Engineering Drawing by Prof.K.L.Narayana & Prof. R.K.Kannaiah, Scitech Publications, 2010.

Reference Book:

1. Engineering Graphics with AutoCAD 2002 by James D. Bethune, PHI, 2011.
2. Engineering Graphics. P I Varghese Tata McGraw Hill Education Pvt. Ltd, 2010.
3. Engineering drawing – P.J. Shah .S.Chand Publishers, 2010.
4. Engineering Drawing- Johle/Tata Macgraw Hill Book Publishers, 2010.
5. Engineering Drawing – M.B. Shah and B.C. Rana, Pearson, 2009.

Web References:

1. https://lecturenotes.in/subject/436/engineering-drawing-ed.
2. web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf.
3. https://www.smartzworld.com/notes/engineering-drawing-pdf-1st-year-notes-ppts
4. https://www.researchgate.net/305754529_A_Textbook_of_Engineering_Drawing
5. www.academia.edu/32510080/N_d_bhatt_engineering_drawing_pdf

B.Tech. I Year II Semester

Course Structure

L	T	P	C
0	0	3	1.5

ENGINEERING PHYSICS LAB

(Common to CE, ME & AME)

Internal Marks: 40

Course code: P18BSL02 **External Marks: 60**

Course Prerequisites: The basics of analytical and conceptual understanding ofphysics.

Course Objective:

1. Deploy scientific method of experiments in the laboratory.
2. Develop the procedures and observational skills for appropriate use of simple and complex apparatus.
3. Enable analytical techniques, statistical analysis and graphical analysis.
4. Reinforce ideas and concepts covered in lecture host of experiments.
5. Train to find the radius of curvature of a Plano-convex lens forming Newton's rings.

Course Outcomes:

6. Apply the phenomenon of interference and diffraction of light waves.
7. Implement the concept of resonance in LCR circuit and sonometer.
8. Analyze the SHM to determine its dependent properties.
9. Evaluate the behavior of electronic components and its characteristics

List of Experiments

(Any eight of the following to be done)

1. Determination of Radius of Curvature of Plano - Convex lens byforming Newton's Rings.
2. Determination of Wavelengths of various spectral linesusing grating with the normal incidence method.
3. Determination of wavelength of laser radiation.
4. Determination of Refractive index of a given prism.
5. Study of magnetic field along the axis of a current carrying coil and toverify stewart Gee's method.
6. Determination of energy gap of PN junction Diode.
7. Determination of hall coefficient and carrier concentration using HALLEFFECT
8. Study V-I characteristics of Zener diode.
9. Study V-I characteristics of PN junction diode.
10. Determination of frequency of a vibrating bar or electrical tuning fork using Melde's apparatus.

11. Determination of acceleration due to gravity using compound pendulum
12. Verification of laws of transverse waves by Sonometer.
13. Velocity of sound by volume resonator.
14. Determination of rigidity modulus by Torsional pendulum.

Text Books:

1. Madhusudhanrao, "Engineering Physics lab manual" Istedition,Scietech Publication, 2015.
2. Ramarao Sri, Choudary Nityanand And Prasad Daruka, "Lab Manualof Engineering physics" Vth ed, Excell books, 2010.
3. Physics lab manual, Department of Physics,PACE Institute ofTechnology and Sciences.

I Year - II Semester

L	T	P	C
0	0	3	1.5

PYTHON PROGRAMMING LAB
(Common to EEE,ME,ECE,CSE,IT,AME Branches)

Course Code: P18ESL04 **Internal Marks: 40**

External Marks: 60

Course Outcomes:

1. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
2. Express different Decision Making statements and Functions.
3. Interpret Object oriented programming in Python.
4. Understand File handling operations.
5. Design GUI Applications.

Exercise1 - Basics

a) Running instructions in Interactive interpreter and a Python Script
b) Write a program to purpose fully raise Indentation Error and Correct it

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem).
b) Write a program add.py that takes 2 numbers as command line arguments andprints its sum.

Exercise 3 – Control Flow

a) Write a Program for checking whether the given number is a even number or not.
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2,1/3,1/4,...,1/10.
c) Write a program using a for loop that loops over a sequence. What is sequence?
d) Write a program using a while loop that asks the user for a number, and prints a count down from that number to zero.

Exercise 4 – Control Flow-Continued

a) Find the sum of all the primes below two million. Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting

with 1 and 2, the first 10 terms will be:1, 2, 3, 5, 8,
13, 21, 34, 55, 89, ...

b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise 5 - DS

a) Write a program to count the numbers of characters in the string and storethem in a dictionary data structure.
b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise 6- DS-Continued

a) Write a program combine_lists that combines these lists into a dictionary.
b) Write a program to count frequency of characters in a given file. Can you usecharacterfrequency to tell whether the given file is a Python program file, C program file or a text file?

Exercise 7 - Files

a) Write a program to print each line of a file in reverse order.
b) Write a program to compute the number of characters, words and lines in a file.

Exercise 8 - Functions

a) Write a function dups to find all duplicates in the list.
b) Write a function unique to find all the unique elements of a list.

Exercise 9 - Functions –Problem Solving

a) Write a function cumulative_product to compute cumulative product ofa list of numbers.
b) Write a function reverse to reverse a list. Without using the reverse function.
c) Write function to compute gcd, lcm of two numbers. Each function shouldn’texceed one line.

Exercise 10 – Multi - D Lists

a) Write a program to perform addition of two square matrices.

b) Write a program to perform multiplication of two square matrices.

Exercise 11 - OOP

Class variables and instance variable and illustration of the self variable

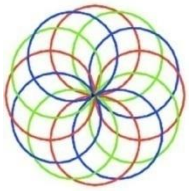
i)Robot.

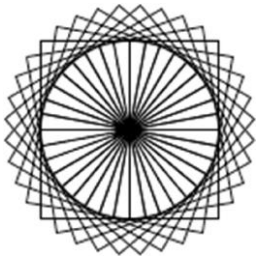
ii)ATM Machine.

Exercise - 12 GUI, Graphics

a) Write a GUI for an Expression Calculator using tk.

b) Write a program to implement the following figures using turtle





B. Tech- I Year I Semester **Course structure**

ENGINEERING WORKSHOP

(Common to all branches)

L	T	P	C
0	0	3	1.5

Internal Marks: 40

Course Code: P18ESL02 **External Marks: 60**

Course Pre-requisite: NIL

Course Objectives:

1. To provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
2. To provide the students hands on experience to make different joints in carpentry with hand tools like jack plane, various chisels & hand saws.
3. To provide the students hands on experience to make different joints in Sheet metal work with hand tools like snips, stacks, nylon mallets etc.
4. To provide the students hands on experience to make different connections in house wiring with hand tools like cutting pliers ,tester ,lamps& lamp holders etc.
5. To develop a right attitude, team working, precision and safety at work place.

Course Outcomes:

At the end of the course the student will be able to

- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
- Familiarize with the basics of tools and equipment used in Carpentry.
- Fabricate various basic components using Sheet metal.
- Apply basic electrical engineering knowledge for house wiring practice.
- Gain the hands on experience to form different models in Black smithy.

LIST OF EXPERIMENTS:

Minimum two experiments should be conducted from each trade

1. **Carpentry** **(6 Lectures)**
   a) Cross-Lap joint
   b) Dove tail joint
   c) T - Lap joint
   d) Mortise & Tenon joint
2. **Fitting** **(6 Lectures)**
   a) Square fit
   b) V - Fit
   c) Half round fit
   d) Dovetail fit
3. **Tin Smithy** **(6 Lectures)**
   a) Rectangular Tray
   b) Cylinder
   c) Square box without lid
   d) funnel
4. **Black Smithy** **(6 Lectures)**
   a) Round rod to Square
   b) S-Hook
   c) Round Rod to Flat Ring
   d) Round Rod to Square headed bolt
5. **House wiring** **(6 Lectures)**
   a) One lamp controlled by one switch
   b) Parallel and Series connections
   c) Fluorescent lamp fitting
   d) Stair case wiring

REFERENCE BOOKS:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers, 2015.
2. Engineering Practices Lab Manual, Jeyapoovan, SaravanaPandian, Vikas publishers, 2009.
3. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House, 2003.

B. Tech I Year I Semester **Course Structure**

L	T	P	C
3	0	0	0

ENVIRONMENTAL SCIENCE

(Common to all Branches)

Course Code: P18MCT01 **Internal Marks: 100**

Course Prerequisite: Basic knowledge about sciences up to intermediate or equivalent level.

Course Objectives:

1. Overall understanding of the natural resources
2. Basic understanding of the ecosystem and its diversity
3. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities
4. An understanding of the environmental impact of developmental activities
5. Awareness on the social issues, environmental legislation and global treaties

Course Outcomes:

At the end of the course, the students will be able to acquire

1. The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
2. The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources
3. Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
4. The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
5. Social issues both rural and urban environment and the possible means to combat the challenges and environmental assessment stages involved in EIA and the environmental audit.

UNIT I **(9 Lectures)**

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: Definition, Scope and Importance– Need for Public Awareness. Renewable energy Resources, Solar energy-solar cells, solar batteries, wind energy, wind mills, ocean energy, tidal energy and nonrenewable energy resources: LPG, water gas, producer gas. World food problems, degradation and Soil erosion - overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging and salinity.

UNIT II **(8 Lectures)**

ECOSYSTEMS: Concept of an ecosystem. – Structure, Components and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Ecological pyramids - Food chains, food webs and Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem. b. Grassland ecosystem c. Desert ecosystem d. Aquatic – River and Lake Ecosystems.

UNIT III **(8 Lectures)**

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

UNIT IV **(9 Lectures)**

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. Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – **Disaster management:** floods, earthquake, cyclone and landslides.

UNIT V **(8 Lectures)**

SOCIAL ISSUES AND THE ENVIRONMENT: From unsustainable to sustainable development – Urban problems related to energy – Water conservation, rain water harvesting

and watershed management –Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Population growth – Impacts on society, variation among nations. Environmental Impact Assessment (EIA) and Environmental Protection Acts.

Text Book:

1. Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi, 2008.

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2. Perspectives in Environmental Studies, Second edition, AnubhaKoushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.

Online References:

1. Environmental Science - Oxford Research Encyclopedia
2. Environmental Science - Museum of Science and Industry
3. Collegesat.du.ac.in/UG/Envinromental%20Studies_ebook.pdf

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
3	1	0	4

ENGINEERING MECHANICS

Internal Marks: 40
Course Code: P18EST05 **External Marks: 60**

Course Prerequisite: Engineering Mathematics, Physics

Course Objectives:

1. Study various types of force systems, basic principles of mechanics of rigid bodies and Calculation the unknown forces through the use of equilibrium equations for a rigid body.
2. Analyze simple trusses using method of joints and method of sections.
3. Study and determine centroids and center of gravity of various composite shapes.
4. Study the concept of moment of inertia and the mathematical calculations involved in finding moment of inertia of two dimensional areas.
5. Learn principle of dynamics and apply it to impulse and momentum, work and energy which is useful to analyze turbo machineries.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the principle of rigid body equilibrium and to determine unknown forces.
2. Analyze the force of friction and trusses using method of Joints and method of sections.
3. Find the centroids and center of gravity of composite areas.
4. Calculate the moment of inertia of various shapes by integration and moment of inertia of composite areas.
5. Understand kinematics, kinetics and rotation of a rigid body.

UNIT – I: **(13 Lectures)**

Systems of forces: Resolution of coplanar and non-coplanar force systems (both concurrent and non-concurrent), Determining the resultant of planar force systems. Moment of force and its applications and couples.

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of force systems.

UNIT – II: **(12 Lectures)**

Analysis of Trusses: Introduction, force calculations using method of joints and method of sections.

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge friction

UNIT – III: **(12 Lectures)**

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications.

Center of gravity: CG of elementary and composite bodies

UNIT – IV: (11 Lectures)

Moment of Inertia: Definition of MI, Polar Moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of elementary & composite areas, product of inertia. Mass moments of inertia for elementary and composite bodies

UNIT – V: (12 Lectures)

Kinematics: Introduction, Rectilinear kinematics: Continuous motion, General curvilinear motion, Curvilinear motion: Rectangular components, Motion of a projectile, Curvilinear motion: Normal and tangential components, Absolute dependent motion analysis of two particles.

Kinetics: Kinetics of a particle-D'Alemberts principle-Motion in a curved path – work, energy and power. Principle of conservation of energy- Kinetics of rigid body in translation, rotation work done-Principle of work-energy-Impulse-momentum.

Text Books:

1. Engineering mechanics-statics and dynamics by A. K. Tayal - Umesh publications, Delhi (For numerical problems) , 2008.
2. Engineering mechanics by S. Timoshenko, D. H. Young and J V Rao -Tata McGraw-Hill Publishing Company Limited, New Delhi(For concepts) , 2009.
3. Engineering Mechanics by Dr. R. Kumaravelan, Scitech Publications, 2014.

Reference Books:

1. Engineering Mechanics by S.S.Bhavikatti, New Age international Publishers 2012.
2. Engineering Mechanics- Statics and Dynamics by Irving H. Shames, Pearson Education , 2006.
3. Singer's Engineering Mechanics: Statics and Dynamics, K.Vijaya Kumar Reddy and J Suresh Kumar, 3rd Edition SI Units-BS Publications , 2010.
4. A Textbook of Engineering mechanics statics and dynamics by J. L. Meriam and L. Kraige , Wiley India , 6th Edition , 2010.

Web References:

1. www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

THERMODYNAMICS

(Use of Steam Tables is permitted in External Examinations)

Internal Marks: 40

Course Code: P18MET01 **External Marks: 60**

Course Prerequisite: Engineering Physics, Mathematics-I&II

Course objectives:

1. To understand the basic concepts like thermodynamic system, boundary, first law of thermodynamics and applications of steady flow energy equation.
2. To understand the second law statements, the associated terms and principles of heat engines.
3. To understand the process of steam formation and its representation on property diagrams with various phase changes.
4. To have the knowledge of Psychrometric chart and calculation of various properties.
5. To understand the concept of air standard cycles and to calculate the efficiency and performance parameters of the systems.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
2. Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
3. Calculate the quality of steam after its expansion in a steam turbine, with the help of standard steam tables and charts.
4. Calculate the properties of gas mixtures and moist air.
5. Calculate the efficiency and performance parameters of the systems.

UNIT-I: **(10 Lectures)**

BASIC CONCEPTS AND FIRST LAW

Introduction of Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale, Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. PMM-I, throttling and free expansion processes

UNIT-II: (9 Lectures)

SECOND LAW, AVAILABILITY AND IRREVERSIBILITY

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Refrigerator, Coefficient of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Concept of Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations, Tds relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT-III: (8 Lectures)

PROPERTIES OF PURE SUBSTANCE

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry. Deviations from perfect gas model – Vander waals equation of state – compressibility charts – variable specific heats – gas tables.

UNIT – IV: (9 Lectures)

GAS MIXTURES AND PSYCHROMETRY

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart, Psychrometric processes.

UNIT – V: (9 Lectures)

POWER CYCLES AND REFRIGERATION CYCLES

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

Vapour Power Cycles: Rankine cycle – Performance Evaluation – combined cycles.

Refrigeration Cycles: Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

Text Books:

4. Engineering Thermodynamics , PK Nag 4th Edn , TMH, 2013.
5. Thermodynamics – An Engineering Approach with student resources DVD – Y.A.Cengel & M.A.Boles , 7th Edn – McGrawHill
6. R.K.Rajput, "A Text Book of Engineering Thermodynamics ", Fifth Edition, 2017.

Reference Books:

6. Engineering Thermodynamics – Jones & Dugan PHI, 2007.
7. Thermodynamics – J.P.Holman , McGrawHill, 2008.
8. Basic Engineering Thermodynamics – A.Venkatesh – Universities press, 2016.
9. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press, 2005.
10. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
11. Engineering Thermodynamics – D.P.Misra, Cengage Publ.
12. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.

Web References:

6. www.nptel.ac.in
7. www.ihed.ras.ru/thermo/thermo_inet.htm
8. www.hyperphysics.phy-astr.gsu.edu
9. www.onlinelibrary.wiley.com

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

METALLURGY & MATERIAL SCIENCE

Internal Marks: 40

Course Code: P18MET02 **External Marks: 60**

Course Prerequisite: Engineering Chemistry and Engineering Physics

Course objectives:

1. To understand the fundamentals of Material science and Physical metallurgy.
2. To gain the knowledge on improvement, selection and utilization of materials.
3. To study the properties and practical applications of cast irons and steels.
4. To study the affect of various alloying elements on iron-iron carbide system and heat treatment processes used in practical applications.
5. To study the properties and applications of ceramic, composite and other advanced materials.

Course Outcomes:

After completion of the course the student will be able to

1. Acquire the knowledge related to the structure and properties of materials and crystal systems
2. Understand the phase diagrams of various alloys.
3. Understand the properties of ferrous materials and their engineering applications.
4. Understand the basic concepts of Heat treatment processes and their applications.
5. Gain knowledge on nonferrous materials, composite materials and basic steps involved in the Powder Metallurgy process .

UNIT-I: **(10 Lectures)**

STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS

Bonds in Solids– Ionic, Covalent and Metallic bonds; Classification of solids – Amorphous and Crystalline solids**.**Crystal structure-BCC, FCC, HCP.

Crystallization of metals– Nuclei formation and Crystal growth, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys, Grain size and methods of grain size measurements; Necessity of alloying, types of solid solutions- substitutional solid solutions and Hume-Rothery rules of solid solubility, interstitial solid solutions, Intermediate alloy phases- Intermetallic, Interstitial and electron compounds.

UNIT-II **(9 Lectures)**

EQUILIBRIUM DIAGRAMS: Introduction to Phase and Phase diagrams with its Importance and types-Unary, Binary and Ternary phase diagrams; Experimental methods of construction of equilibrium diagrams, Lever rule , Study of important binary phase diagrams of Fe-Fe3C and Cu -Ni.Micro constituents in steels- Austenite, Isomorphous alloy systems Ferrite, Cementite, Pearlite, Bainite, Martenite; eutectic, peritectic, eutectoid and peritectoid reactions. Cooling curve of pure iron, Lever Rule, Gibbs Phase Rule.

UNIT-III **(8 Lectures)**

STEELS: Introduction, Classification and Influence of constituents on steel; Structure, properties and applications of plain carbon steels; Alloy steels-Purpose and effect of alloying elements; Properties of - manganese steels, Stainless steels, tool and die steels.

CAST IRONS: Introduction, comparison with steels and Classification; Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, S.G. cast iron.

UNIT – IV: **(9 Lectures)**

HEAT TREATMENT OF ALLOYS: Introduction to furnaces and purpose of heat treatment; Process and applications of Annealing, normalizing, Hardening and tempering; Effect of cooling on austenite transformation, TTT diagrams, Hardenability and factors affect hardening; Surface Hardening of Steels- Carburizing, Nitriding, Cyaniding ,

UNIT – V: **(9 Lectures)**

CERAMICS: Introduction; Crystalline ceramics, glasses, ceramets, abrasive materials.

COMPOSITE MATERIALS: Composites- Introduction, types-particle reinforced, fiber reinforced and structural composites, applications and reinforcing materials.

POWDER METALLURGY - Introduction, preparation, industrial applications, advantages and limitations.

Text Books:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill, 2007
2. Essential of Materials science and engineering - Donald R.Askeland - Cengage, 2019.
3. KennethG.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4 th Indian Reprint 2002.

Reference Books:

1. Material Science and Metallurgy – Dr. V.D.Kodgire, Everest Publishing House, 2018.
2. Materials Science and engineering - Callister & Baalasubrahmanyam, Wiley India Pvt. Limited, 2009.
3. Material Science for Engineering students – Fischer – Elsevier Publishers, 2009.
4. Material science and Engineering - V. Rahghavan, PHI publishers, 2015
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press, 2010.
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications, 2014.
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publication, 2012.
8. “Material Science and Engineering”, by William D Callsber John Wiley and Sons 1997.

Web References:

1. www.nature.com
2. www.synl.ac.cn
3. www.web.archive.org
4. www.nptel.ac.in

B. Tech- II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

MATHEMATICS-III
(Numerical methods and Fourier analysis)

(Common to All Branches)

Internal marks: 40

Course code: P18BST03 **External Marks: 60**

Course Prerequisite: Mathematics-I, Mathematics-II (P18BST01)

Course Objectives:

1. The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
2. The Fourier series of a periodic function and its application to the solution of partial differential equations.
3. To calculate the Fourier transform or inverse transform of common functions. including Delta, Unit-Step.
4. Learn to find Solution of One dimensional Wave, Heat equation.

Course Outcomes:

After learning the contents of this paper the student must be able to

1. Calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators.
2. Solve ordinary differential equations numerically using Euler's and RK method.
3. Analyze the spectral characteristics of signals using Fourier analysis. Classify systems based on their properties and determine the response
4. Find Fourier series and Fourier transforms for certain functions.
5. Identify/classify and solve the different types of partial differential equations.

UNIT- I: **(10 Lectures)**

Solution of Algebraic and Transcendental Equations and Interpolation:

Introduction- Bisection method – Method of false position – Newton- Raphson method.

Interpolation: Introduction- Forward differences- Backward differences. Newton's formula for interpolation- Lagrange's interpolation formula.

UNIT- II: **(9 Lectures)**

Numerical Integration and solution of Ordinary Differential equations:

Trapezoidal rule- Simpson's 1/3rd and 3/8th rule, Solution of ordinary differential equations by Taylor's series- Euler's method –Modified Euler's method, Runge- Kutta method of fourth order.

UNIT- III: **(9 Lectures)**

Fourier Series: Introduction- Determination of Fourier coefficients – even and odd functions – change of interval– Half-range sine and cosine series.

UNIT- IV: **(8 Lectures)**

Fourier Transforms: Fourier integral theorem (only statement) – Fourier sine and cosine integrals - sine and cosine transforms – properties – inverse transforms – Finite Fourier Transforms.

UNIT -V: **(9 Lectures)**

First order Partial differential equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations. Method of separation of Variables- Solution of One dimensional Wave, Heat equation.

Text Books:

1. Higher Engineering Mathematics by B.S.Grewal, 43rd Edition, Khanna Publishers, 2015.
2. Engineering Mathematics by N.P.Bali, Lakshmi Publications, 2011.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 10th Edition, Wiley-India
2. Advanced Engineering Mathematics by Micheael Greenberg, 9th edition, Pearson edn, 2002.
3. Advanced engineering mathematics with MATLAB by Dean G. Duffy, CRC Press, 2003.
4. Advanced Engineering Mathematics by Peter O'neil, Cengage Learning, 2011.
5. Engineering Mathematics by Srimanta Pal, Subodh C.Bhunia, Oxford University Press, 2015.
6. Higher Engineering Mathematics by Dass H.K., Rajnish Verma. Er., S. Chand Co.Pvt. Ltd, Delhi, 2011.

Web References:

1. www.tutorial.math.lamar.edu
2. www.mathworld.wolfram.com
3. www.nptel.ac.in

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

FLUID MECHANICS & HYDRAULIC MACHINES

Internal Marks: 40

Course Code: P18MET03 **External Marks: 60**

Course Prerequisites: Engineering Mechanics, Mathematics.

Course Objectives:

1. To know the properties of fluids and concept of control volume.
2. To analyse the applications of the laws of conservation for closed conduit flow.
3. To understand the importance of dimensional analysis.
4. To understand the impact force acting on different positioned and angled vanes.
5. To understand the importance of various types of flow in turbines and pumps.

Course Outcomes:

After completion of the course the student will be able to,

1. Understand the properties like viscosity, surface tension and vapor pressure.
2. Calculate the flow rates using pilot tube, venturimeter, and orifice meter, Flow nozzle and Turbine flow meter.
3. Understand the Bernoulli's equations, Darcy Weisbach equation, Minor losses.
4. Understand the impact of jets and operation of hydraulic machineries.
5. Evaluate the performance characteristics of hydraulic turbines & pumps. Also a little knowledge on hydraulic systems and fluidics is imparted to the student.

UNIT-I: (9 Lectures)

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressures – measurement of pressure.Pascal's law, hydrostatic law.Concept of control volume – application of continuity equation, energy equation and momentum equation.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height.Stability analysis and applications.

UNIT-II: (9 Lectures)

Fluid kinematics & dynamics: Introduction, flow types. Equation of continuity for one dimensional flow, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. surface and body forces – Euler's and Bernoulli's equations for flow along a stream line.

Closed conduit flow: Boundary layer concepts – types of boundary layer thickness.Dimensional Analysis: Similitude and modeling – Dimensionless numbers. Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT-III: **(9 Lectures)**

Basics of 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 and efficiency, flow over radial vanes.

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- theoryfunctions and efficiency.

UNIT – IV: **(9 Lectures)**

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems, hydraulic ram, hydraulic lift, hydraulic coupling.

Fluidics: amplifiers, sensors and oscillators. Advantages, limitations and applications

UNIT – V: **(9 Lectures)**

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Text Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH, Rajsons Publications Pvt. Limited, 2017
2. Fluid Mechanics and Hydraulic Machines by Rajput, SCHAND publications, 2016.
3. Fluid Mechanics and Hydraulic Machines by RK Bansal, Laxmi Publications (P) Ltd, 2018.

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons, 2013.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International, 2007.
3. Instrumentation for Engineering Measurements by James W. Dally, William E. Riley ,John Wiley & Sons Inc. 2004 (Chapter 12 – Fluid Flow Measurements)
4. Fluid Mechanics and Hydraulic Machines by Domkundwar & Domkundwar, Dhanpatrai & Co, 2016.

Web References:

1. www.mechengg.net
2. www.efluids.com
3. www.hydraulic-machines.com

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
1	0	4	3

COMPUTER AIDED MACHINE DRAWING

Internal Marks: 40

Course Code: P18MEL01 **External Marks: 60**

Course Prerequisite: Engineering Graphics

Course Objectives:

1. To involve the students in modeling of various mechanical components and their parts in Machine drawing.
2. To enable the students to acquire requisite knowledge, techniques how to connect the various assembly components.
3. To enable the students to gain the knowledge in making 2D,3D modeling of simple machine parts and assembly drawings through modeling software's.

Course Outcomes:

At the end of the course, the student will be able to

1. Draw the basic proportionate drawings for bearings, fasteners, various joints etc.
2. Combine parts to form an assembly of mechanical components such as stuffing box, screw jack and connecting rod etc., using modeling soft wares.
3. Draft the sectional views of assembled components.

PART – A: COMPUTER AIDED DRAWING OF COMPONENTS

- Introduction to Machine Drawing conventions: Need for drawing conventions – Introduction to ISI conventions.
- Introduction to computer aided drafting; advantages and applications of CAD, concepts of computer aided 2D drafting using any drafting software, basic draw and modify commands, making 2D drawings of simple machine parts.
- Introduction to Geometrical Dimensioning and Tolerances
  Note: First angle projection to be adopted.

List of Exercises:

1) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs, dimensioning types, lines and rules of dimensioning.
2) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
3) Popular forms of Screw threads, bolts, and nuts.
4) Cotter joint and knuckle joint.
5) Riveted joints for plates.
6) Spigot and socket pipe joint.
7) Journal bearing and foot step bearing.

PART – B: COMPUTER BASED SOLID MODELING

- Introduction to assembly drawing, steps in making of assembly drawing
- Introduction to any 3D modeling software, basic commands and development of 3D drawings of simple machine parts and assemblies.

List of Exercises:

8) Part modeling & views
9) Assembly of stuffing box
10) Assembly of screw jack
11) Assembly of engine connecting rod and piston assembly
12) Assembly of lathe tailstock.
13) Assembly of feed check valve
14) Drafting of assembled components showing various views and sections

Software Packages:

AutoCAD, FUSION360, Cero 4.0.

Text Books:

1. Machine Drawing, by K.L.Narayana, P.Kannaiah and K. Venkata Reddy 3rd Edition, New Age Publishers, 2009.
2. Machine Drawing with AutoCAD, by Goutam Pohit and Ghosh, Pearson Education, 2007.

Reference Books:

1. Machine Drawing, N D Bhatt , 44th Edition, Charotar Publishers, 2009.
2. Machine Drawing, Dhawan, S.Chand Publications, 2005.
3. Machine Drawing, P.S.Gill, S.Chand Publications, 2005

Web References:

1. www.academia.edu
2. www.nptel.com/machine drawing.pdf

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

METALLURGY LAB

Internal Marks: 40

Course Code: P18MEL02 **External Marks: 60**

Course Prerequisites: Metallurgy and Engineering materials.

Course Objective:

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

Course Outcomes:

After completion of the laboratory student will be able to

1. Acquire the knowledge related to the structure and properties of materials and crystal systems.
2. Experiment with different materials for the evaluation of material properties through various destructive testing procedures.
3. Examine the microstructures of different materials and also identify the hardness values.
4. Can operate optical microscope with an ease.
5. Characterize microstructures of engineering alloys using optical microscopy and image analyzer.

List of Experiments:

1. Preparation and study of crystal models for simple cubic, body centered cubic, and face centered cubic and hexagonal close packed structures.
2. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
3. Grain size measurement by different methods.
4. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C 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. Study of Microstructures of different alloy steels.
9. To find the hardenability of steels by Jominy End Quench Test.
10. To find out the hardness of various treated and untreated steels.

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

FLUID MECHANICS & HYDRAULIC MACHINES LAB

Internal Marks: 40

Course Code: P18MEL03 **External Marks: 60**

Course Prerequisites: Engineering mechanics, Mathematics.

Course Objectives:

1. Measurement of flow through the orifice meter and venture meter.
2. Determine the friction factor for a given set of pipes and Darcy Weis bach equation- Minor losses
3. Verifying Bernoulli's theorem and applying it to any flow devices.
4. Determining head loss due to sudden contractions in pipelines.
5. Understands the impact of jets and operation of hydraulic machineries.
6. Understand to evaluate the performance characteristics of hydraulic turbines. Also a little knowledge on hydraulic systems and fluidics is imparted to the student.

Course Outcomes:

After completion of the course the student will be able to:

1. Calculate the pressure using various manometers.
2. Calculate the discharge of various equipment's.
3. Calculate the friction factor of different pipes
4. Conduct performance tests on various pumps and turbines.
5. Identify the force on different vanes.

List of Experiments:

Conduct any 12 of the 15 experiments.

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturi meter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.
13. Bernoulli's Theorem Apparatus
14. Reynolds's Apparatus
15. Determination of Co-efficient of Discharge for an Mouth Piece and Orifice

B.Tech. II Year I Semester **Course Structure**

L	T	P	C
2	0	0	-

PROFESSIONAL ETHICS AND HUMAN VALUES

Course Code: P18MCT03
Course Prerequisite: NIL

Course Objectives:

1. To introduce the students to the Human values and help them to lead a peaceful life in the society by contributing to peace and safety in the society.
2. To help the students to know about the history of ethics and importance of social experimentation
3. To specify the students about the importance of their responsibility towards safety and risk as Engineers.
4. To specify the students about the importance of their responsibility as Engineers.
5. To help the student explore the ethical values globally.

Course Outcomes:

1. To learn about the different Human values to be maintained by all the people.
2. To learn about the history of ethics and the importance of ethics for professionals and application of ethics in social experimentation.
3. To learn about the responsibilities of engineers for safety and risk.
4. To learn about the responsibilities and rights of engineers.
5. To learn about global work environment with respect to ethics.

UNIT- I: **(5 Lectures)**

Human Values: Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality-Character.

UNIT- II: **(8 Lectures)**

Engineering Ethics: The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics - Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-Engineering and Ethics-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

Engineering as Social Experimentation: Comparison with Standard Experiments – Knowledge gained – Conscientiousness – Learning from the Past – Engineers as Managers, Consultants, and Leaders – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT- III: (5 Lectures)

Engineers' Responsibility for Safety and Risk: Safety and Risk, Concept of Safety – Types of Risks – Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk Benefit Analysis-Accidents.

UNIT- IV: (7 Lectures)

Engineers' Responsibilities and Rights: Collegiality-Techniques for Achieving Collegiality – Two Senses of Loyalty - obligations of Loyalty-misguided Loyalty – professionalism and Loyalty - Professional Rights –Professional Responsibilities – confidential and proprietary information-Conflict of Interest-solving conflict problems – Self-interest, Customs and Religion- Ethical egoism-Collective bargaining Confidentiality-Acceptance of Bribes/Gifts-when is a Gift and a Bribe examples of Gifts v/s Bribes-problem solving-interests in other companies Occupational Crimes-industrial espionage-price fixing-endangering lives Whistle Blowing-types of whistle blowing-when should it be attempted preventing whistle blowing.

UNIT- V: (5 Lectures)

Global Issues: Globalization- Cross-culture Issues-Environmental Ethics-Computer Ethics computers as the instrument of Unethical behavior-computers as the object of Unethical Acts-autonomous computers-computer codes of Ethics Weapons Development-Ethics and Research-Analyzing Ethical Problems in Research-Intellectual Property Rights.

Text Books:

1. Engineering Ethics and Human Values by M.Govindarajan, S.Natarajan and V.S. Senthil Kumar-PHI Learning Pvt. Ltd, 2009.
2. Professional Ethics and Morals by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
3. Professional Ethics and Human Values by A.Alavudeen, R.Kalil Rahman and M. Jayakumaran- Laxmi Publications, 2016.
4. Professional Ethics and Human Values by Prof. D.R. Kiran, TMH Publications, 2013.

Reference Books:

1. Indian Culture, Values and Professional Ethics by PSR Murthy, BS Publication, 2013.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
3. Engineering Ethics by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

Web References:

1. www.nptel.ac.in
2. www.crectirupati.com

B. Tech- II Year II Semester **Course Structure**

L	T	P	C
3	1	0	4

MATHEMATICS-IV
(PROBABILITY AND STATISTICS)

(Common to CIVIL, MECH, CSE, IT, &AME Branches)

Internal Marks: 40

Course code: P18BST04 **External marks: 60**

Course Objectives: To learn

1. The subject gives knowledge about discrete random variable and discrete probability distributions.
2. The subject gives the knowledge of continuous random variable and continuous probability distributions.
3. The students will learn sampling distributions with replacement, without replacement point estimation, maxium error of estimate and interval estimation.
4. The student will learn testing procedure of hypothesis, applications of t-test, test for ratio of variances and Chi-square test.
5. To introduce numerical techniques to solve the real world applications.

Course Outcomes:

At the end of the Course, Student will be able to

1. Examine, analyze, and compare various Probability distributions for discrete random variables.
2. Examine, analyze, and compare various Probability distributions for continuous random variables.
3. Describe and compute confidence intervals for the mean of a population.
4. Describe and compute and test the hypothesis concerning mean, difference of means and goodness of fit
5. Fit a curve to the numerical data.

UNIT-I: **(12 Lectures)**

Discrete Random variables and Distributions: Introduction-Random variables- Discrete Random variable-Distribution function- Expectation- Moment Generating function-Moments and properties.

Discrete distributions: Binomial, Poisson distributions and their fitting to data.

UNIT-II: **(12 Lectures)**

Continuous Random variable and distributions: Introduction-Continuous Random variable-Distribution function- Expectation-Moment Generating function-Moments and properties.

Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution - Gamma distribution.

UNIT-III: (12 Lectures)

Sampling Theory: Introduction - Population and samples- Sampling distribution of means (σ known)-Central limit theorem- Sampling distribution of means (σ unknown)- Sampling distribution of variances -- Point estimation- Maximum error of estimate - Interval estimation.

UNIT-IV: (12 Lectures)

Tests of Hypothesis: Introduction –Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two-tail tests- t-test for single mean, difference of means and correlation coefficients , test for ratio of variances- Chi-square test for goodness of fit and independence of attributes

UNIT-V: (12 Lectures)

Curve fitting and Correlation: Introduction - Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares-Goodness of fit.
Correlation and Regression – Rank correlation.

Text Books:

1. Probability and Statistics for Engineering and the Sciences, Jay l.devore, 8th edition,Cengage, 2010.
2. Probability an Statistics for Engineering by Richards A Johnson, Irvin Miller and Johnson E Freund, 9th Edition, PHI, 2017.
3. Probability and Statistics by T. K.V. Iyengar, B.Krishna Gandhi, M.V.S.S.N. Prasad. S.CHAND,5th Edition, 2014

Reference Books:

1. Probability and Statistics Engineers and the Scientists, Shron L.Myers, Keying Ye, Ronald E Walpole, 8th Edition, Pearson, 2007.
2. Introduction to probability and statistics, William Menden Hall, Robert J. Bever and Barbara Bever, Cengage learning, 2009.
3. Introduction to probability and statistics Engineers and the Scientists, Sheldon, M. Rosss, 4th edition, Academic Foundation, 2011.
4. Applied statistics for Engineers and Physical Scientists, Johannes Ledolter and Robert V.Hogg, 3rd Edition, Pearson, 2010.

Web References:

1. www.tutorial.math.lamar.edu
2. www.mathworld.wolfram.com
3. www.nptel.ac.in

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

PRODUCTION TECHNOLOGY

Internal Marks: 40

Course Code: P18MET04 **External Marks: 60**

Course Prerequisite: Metallurgy and Engineering materials

Course Objectives:

1. Understand fundamentals of casting.
2. Provide insight into sand casting and introduce other advanced casting processes.
3. Impart fundamentals of gas welding, arc welding and principles of advanced welding processes and their applications.
4. Impart knowledge on bulk forming processes and powder metallurgy.
5. Understand the various sheet metal forming processes like blanking, piercing, deep drawing and processing of plastics.

Course Outcomes:

After completion of the course the student will be able to

1. Expose and understand the fundamentals of casting
2. Understand the sand casting and other advanced casting processes
3. Understand the various welding processes and their applications
4. Gain knowledge on forging, rolling and extrusion processes.
5. Understand the various sheet metal forming and processing of plastics.

UNIT-I: **(9 Lectures)**

CASTING: Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems

UNIT-II: **(8 Lectures)**

Methods of melting and types of furnaces, Solidification of castings, Solidification of pure metals and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, Basic principles and applications of Centrifugal casting, Die casting and Investment casting.

UNIT-III: **(10 Lectures)**

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, Manual metal arc welding, Sub merged arc welding, Inert Gas welding- TIG & MIG welding.

Resistance welding, Solid state welding processes- Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma welding, Laser welding, electron beam welding, Soldering & Brazing.
Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds, Design of welded joints.

UNIT – IV: (9 Lectures)

Plastic deformation in metals and alloys, Hot working and Cold working, Strain hardening and Annealing. Bulk forming processes: Forging - Types Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements.
Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.
Introduction to powder metallurgy – compaction and sintering, advantages and applications

UNIT – V: (9 Lectures)

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Springback and its remedies, Coining, Spinning, Types of presses and press tools. Processing of Plastics: Types of Plastics, Properties, Applications and their processing methods, Blow and Injection molding.

Text Books:

1. Manufacturing Processes for Engineering Materials - Kalpakjian S and Steven R Schmid- Pearson Publ , 5th Edn, 2007.
2. Fundamentals of Modern Manufacturing - Mikell P Groover- Wiley publ – 3rd Edition, 2009.
3. Manufacturing Technology by P.N. Rao, TMH, 5th Edition, 2013.

Reference Books:

1. Production Technology by R.K. Jain, Khanna Publishers,17th Edition, 2011.
2. Metals Handbook Vol. 5 published by ASM, Ohio, 1994.
3. Foundry Technology – Dharmendra kumar & S.K.Jain, CBS Publisher, 2007.
4. Production Technology- R.K. Jain- Khanna, 2004.
5. Production Technology-P C Sharma-S. Chand, 2006.
6. Manufacturing Processes- H.S. Shaun- Pearson, 2012.
7. Manufacturing Processes- J.P. Kaushish- PHI, 2010.

Web References:

1. www.lecturenotes.in
2. www.sciencedirect.com
3. www.elsevier.com/books/foundry-technology/beeley
4. www.zollern.com
5. www.slideshare.net

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

THERMAL ENGINEERING - I

Internal Marks: 40

Course Code: P18MET05 **External Marks: 60**

Course Prerequisite: Thermodynamics

Course Objectives:

1. To make the student learn and understand the reasons and affects of various losses that occurs in the actual engine operation.
2. To familiarize the student with the various engine systems along with their function and necessity.
3. To make the student learn to perform testing on S.I and C.I Engines for the calculations of performance and emission parameters.
4. To make the students learn about the performance of IC engines.
5. To make students learn mechanical details, and to calculate power and efficiency of rotary and reciprocating compressors.

Course Outcomes:

After completion of the course the student will be able to

1. Understand how the fundamental sciences of thermodynamics and fluid mechanics impact on the operation, performance and design of internal-combustion engines
2. Understand how the different systems are used in automobile engines.
3. Understand the combustion processes of fuels and common combustion faults in internal combustion engines and knocking.
4. Understand the performance of IC engines using various parameters.
5. Understand the methods of improving the efficiencies of air compressors.

UNIT-I: **(8 Lectures)**

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency, Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT-II: **(8 Lectures)**

I. C. ENGINES: Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems –Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and
turbo charging.

UNIT-III: (11 Lectures)

Combustion in S.I. Engines - Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, antiknock additives – combustion chamber – requirements, types.

Combustion in C.I. Engines - Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence –open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – IV: (8 Lectures)

Measurement, 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.

UNIT – V: (10 Lectures)

Reciprocating Air Compressors: Classification, Operation, Effect of clearance volume, compression ratio, volumetric efficiency, power input, Single-stage and Multi-stage compressors, Effect of inter-cooling, optimum intermediate pressure in a two-stage compressor.

Rotary Compressors: Introduction, Types and their applications, principles of working, static and total head values, Centrifugal compressor- velocity vector diagrams, pressure coefficient, pre whirl, Axial flow compressor - polytropic efficiency, Surging, Choking and Stalling, Centrifugal compressor versus axial flow compressor.

Text Books:

1. I.C. Engines by V. Ganesan- TMH, 2012.
2. Treatise on heat Engineering by Vasandani & Kumar-Metropolitan Book Company, NewDelhi, 2008.
3. Thermal Engineering by Rajput - Laxmi Pub, New Delhi, 2015.
4. IC Engines by M.L.Mathur & R.P.Sharma – Dhanpath Rai & Sons, 2014.

Reference Books:

1. I.C. Engines - J.B.Heywood /McGraw-Hill, 2017.
2. Thermal Engineering – R.S.Khurmi & J.S.Gupta- Chand Publications, 2006.
3. Thermal Engineering / PL Ballaney, Khanna Publishers, 2005.
4. I.C. Engines – Applied Thermo sciences – C.R. Ferguson & A.T. Kirkpatrick- 2ndEdition-Wiley Publications, 2015.

Web References:

1. www.howstuffworks.com

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
3	1	0	4

MECHANICS OF SOLIDS

Internal Marks: 40

Course Code: P18MET06 **External Marks: 60**

Course Prerequisite: Engineering Mechanics.

Course objectives:

1. To extend knowledge of various stresses-strains, poisons ratio and strain energy in members under different loadings.
2. To describe and analyze the shear force and bending moment diagrams of various beams subjected to different loads.
3. To come across the flexural stresses, section modulus and the distribution of shear stress in the beams of various sections.
4. To find slope and deflection for different support arrangements by Double integration method, Macaulay's method and Moment-Area and also problem solving techniques.
5. To analyze stresses induced and the failure criterion in Thin and Thick cylinders.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the fundamental concepts of stress, strain and analyze the stresses on inclined planes for solids.
2. Analyze and design the shear force and bending moment diagrams for various types of beams under different loads.
3. Compute the bending stress and shear stress induced in the beams for various cross sections.
4. Interpret the slope and deflection of beams by Double Integration method and Macaulay's method.
5. Evaluate the stresses and deformation in thin, thick cylinders and spherical shells

UNIT-I: **(12 Lectures)**

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

UNIT-II: **(11 Lectures)**

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.

UNIT-III: (12 Lectures)

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

UNIT – IV: (15 Lectures)

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.

UNIT – V: (10 Lectures)

THIN CYLINDERS AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells- lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

Text Books:

1. Strength of Materials, S.S.Rattan., Tata McGraw-Hill Education, 2011.
2. A Textbook of Strength of Materials, R. K. Bansal., Laxmi Publications, 2010.
3. Strength of Materials, Geoffrey Harwood Ryder., Macmillan, 1961.

Reference Books:

1. Mechanics of Materials, SI Edition, James M. Gere, Barry J. Goodno., 8TH Edition, Cengage Learning, 2012.
2. Hibbeler, R.C., "Mechanics of Materials, Hibbeler, R.C., Pearson Education, Low Price Edition, 2007.
3. Strength of Materials by R.S. Khurmi; S. Chand & Co. 2005

Web References:

1. www.tutorialspoint.comp
2. www.nist.gov
3. www.swayam.gov.in
4. www.mechanicalc.com
5. www.web.mst.edu

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Internal Marks: 40

Course Code: P18HST03 **External Marks: 60**

Course Prerequisite: NIL

Course Objectives:

1. The Learning objective of this Unit is to understand the concept and nature of Managerial Economic s and its relationship with other disciplines, Concept of Demand and Demand forecasting.
2. The Learning objective of this Unit is to understand the concept of Production function, Input Output relationship, different Cost Concepts and Concept of Cost-Volume-Profit Analysis.
3. The Learning Objective of this Unit is to understand the Nature of Competition, Characteristics of Pricing in the different market structure and significance of various pricing methods and to know the different forms of Business organization
4. The Learning objective of this Unit is to understand the different Accounting Systems preparation of Financial Statements and uses of different tools for performance evaluation
5. The Learning objective of this Unit is to understand the concept of Capital, Capitalization, Capital Budgeting and to know the techniques used to evaluate Capital Budgeting proposals by using different methods

Course Outcomes:

1. The Learner is equipped with the knowledge of estimating the Demand for a product and the relationship between Price and Demand.
2. One should understand the Cost Concepts for decision making and to estimate the least cost combination of inputs.
3. One has to understand the nature of different markets and Price Output determination under various market conditions and with the knowledge of different Business Units.
4. The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
5. The Learner is able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

UNIT – I: **(9 Lectures)**

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics-Scope of Managerial Economics and its relationship with other subjects-Concept of Demand, Types of Demand, Determinants of Demand-Demand Schedule, Demand Curve, Law of Demand and its limitations-Elasticity of Demand-Types of Elasticity of Demand and Measurement-Demand forecasting and its Methods.

UNIT – II: **(9 Lectures)**

Production and Cost Analyses: Concept of Production function-Cobb-Douglas Production Function – Law of one Variable proportions-Isoquants and Isocosts and choice of Least cost factor combination-Concepts of Returns to Scale and Economics of Scale-Different Cost

Concepts: Opportunity Costs, Explicit Costs and Implicit Costs -Fixed Costs, Variable Costs and Total Costs - Cost Volume Profit analysis - Determination of Break-Even Point (Simple Problem) Managerial Significance and limitations of Breakeven point.

UNIT – III: (10 Lectures)

Introduction to Markets and Types of Business Organization:

Market Structures: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price and Output Determination– Other Methods of Pricing: Average Cost Pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company –Private Public Partnership - State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle.

UNIT – IV: (8 Lectures)

Introduction to Accounting & Financing Analysis: Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements (Simple Problems) GST basic concepts and Slab rates.

UNIT – V: (9 Lectures)

Capital and Capital Budgeting Capital Budgeting: Meaning of Capital-Meaning of Capital Budgeting-Time value of Money-Methods of appraising Project profitability: Traditional methods (payback period, accounting rate of return) and Modern Methods (Discounted cash flow method, Net present value method, internal rate of return method and profitability index)

Text Books :

1. Managerial Economics and Financial Analysis by Dr. N. Appa Rao, Dr. P. Vijay Kumar: Cengage Publications, New Delhi – 2011.
2. Managerial Economics and Financial Analysis by Dr. A. R. Aryasri, TMH 2011.
3. Managerial Economics and Financial Analysis by Prof. J.V.Prabhakara rao, Prof. P. Venkatarao. Ravindra Publication, 2011.

Reference Books:

1. Managerial Economics, V. Maheswari, Sultan Chand, 2014.
2. Managerial Economics, Suma Damodaran, Oxford 2011.
3. Managerial Economics & Financial Analysis by Dr. B. Kuberudu and Dr. T. V. Ramana, Himalaya Publishing House, 2011.
4. Managerial Economics by Vanitha Agarwal, Pearson Publications 2011.
5. Financial Accounting for Managers by Sanjay Dhameja, Pearson, 2015.
6. Financial Accounting by Maheswari, Vikas Publications, 2012.
7. Managerial Economics and Financial Analysis by S. A. Siddiqui & A. S. Siddiqui New Age International Publishers, 2012.

Web References:

1. www.lecturenotes.in
2. www.nptel.ac.in
3. www.crectirupati.com

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
0	0	3	1.5

MECHANICS OF SOLIDS LAB

Internal Marks: 40

Course Code: P18MEL04 **External Marks: 60**

Course Prerequisites: Chemistry & Physics.

Course Objectives:

After end of thiscourse student will know:

1. To impart practical knowledge on the evaluation of material properties through various destructive testing procedures.
2. The student will perform tests on materials in tension, compression, torsion, bending, and impact.
3. These conditions and/or constraints are designed to reinforce classroom theory by having the student perform required tests, analyze subsequent data, and present the results in a professionally prepared report.

Course Outcomes:

At the end of the course, the student will be able to

1. Conduct tension test on steel, aluminum, copper and brass.
2. Perform compression tests on spring and wood.
3. Determine elastic constants using flexural and torsion tests.
4. Determine hardness of metals.

List of Experiments:

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

Web References:

1. www.sm-nitk.vlabs.ac.in/

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
0	0	3	1.5

PRODUCTION TECHNOLOGY LAB

Internal Marks: 40

Course Code: P18MEL05 **External Marks: 60**

Course Prerequisites: Metallurgy and Engineering materials

Course Objectives:

To impart hands-on practical exposure on manufacturing processes and equipment.

Course Outcomes:

After completion of the laboratory student will be able to

1. Operate different welding machines.
2. Perform moldings on injection and blow molding equipment.
3. Prepare mould cavities of various shapes.
4. Prepare different patterns.
5. Perform metal forming operations.

Minimum of 12 Exercises need to be performed

I. METAL CASTING:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - for strength and permeability
3. Mould preparation, Melting and Casting

II WELDING:

1. Gas welding
2. Gas cutting
3. Manual metal arc welding - Lap & Butt Joints
4. TIG/MIG Welding
5. Resistance Spot Welding
6. Brazing and soldering

III METAL FORMING AND POWDER METALLURGY:

1. Blanking & Piercing operations and study of simple, compound and progressive dies.
2. Deep drawing and extrusion operations.
3. Bending and other operations
4. Basic powder compaction and sintering

IV PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
0	0	3	1.5

THERMAL ENGINEERING LAB

Internal Marks: 40

Course Code: P18MEL06 **External Marks: 60**

Course Objective:

To understand the basic principles in the areas of internal combustion engines, reciprocating air compressors, boilers.

Course Outcomes:

After the completion of the course, students should be able to

1. Identify the various fuel characterizations through experimental testing.
2. Analyze the performance characteristics of an internal combustion engines
3. Evaluate the fuel characteristics.
4. Evaluate the emission characteristics
5. Analyze the air compressor characteristics
6. Study working principles of water tube and fire tube boilers.

List of Experiments:

1. Valve timing diagrams of SI and CI engines.
2. Port timing diagram on two stroke petrol engine.
3. Testing of Fuels – Viscosity, flash point and fire point
4. I.C. Engines performance test on 4 -stroke single cylinder diesel engine.
5. I.C. Engines performance test on 2-stroke single cylinder petrol engine.
6. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
7. Determination of FP by retardation on IC engine on 4 -stroke single cylinder diesel engine.
8. Heat balance sheet on 4 stroke single cylinder diesel engine.
9. Performance test on reciprocating air compressor test rig.
10. Disassembly and assembly of different parts of two wheelers and 4 wheeler vehicles.
11. Study of boilers, mountings and accessories.
12. Exhaust emission measurements of diesel engines and petrol engines.

B.Tech. II Year II Semester **Course Structure**

L	T	P	C
2	0	0	-

CONSTITUTION OF INDIA

Course Code: P18MCT04
Course Prerequisite: NIL

Course Objectives:

1. To know about Indian constitution.
2. To know about central government functionalities in India.
3. To know about state government functionalities in India.
4. To know about functions of Indian Constitution
5. To know about Indian society.

Course Outcomes:

Upon completion of the course, students will be able to

1. Understand the background and structure of Indian Constitution
2. Understand the functions of the Indian government
3. Understand the functions of the State government
4. Understand and abide the rules of the Indian constitution.
5. Understand and appreciate different culture among the people.

UNIT - I : **(6 Lectures)**

INTRODUCTION: Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT - II : **(6 Lectures)**

STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT: Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT - III : **(6 Lectures)**

STRUCTURE AND FUNCTION OF STATE GOVERNMENT: State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT - IV : **(6 Lectures)**

CONSTITUTION FUNCTIONS: Indian Federal System – Center – State Relations – President‟s Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.

UNIT - V : **(6 Lectures)**

INDIAN SOCIETY

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Text Books:

1. Introduction to the Constitution of India, Durga Das Basu, Prentice Hall of India, New Delhi, 2013.
2. Indian Political System by R.C.Agarwal, S.Chand and Company, New Delhi, 1997.
3. Society: An Introduction Analysis by Maciver and Page, Mac Milan India Ltd., New Delhi, 1997.
4. Social Stratification in India: Issues and Themes by K.L.Sharma, Jawaharlal Nehru University, New Delhi, 1997.

Reference Books:

1. Introduction to the Constitution of India by Sharma, Brij Kishore, Prentice Hall of India, New Delhi, 2011.
2. Indian Political System by U.R.Gahai, New Academic Publishing House, Jalaendhar, 2017.
3. Indian Social Problems by R.N. Sharma, Media Promoters and Publishers Pvt. Ltd, 1986.

Web References:

1. www.india.gov.in
2. www.legislative.gov.in
3. www.constitution.org

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

THEORY OF MACHINES

Internal Marks: 40

Course Code: P18MET07 **External Marks: 60**

Course Prerequisite: Engineering Mechanics

Course Objectives:

6. To understand the kinematics and rigid- body dynamics of kinematically driven machine components
7. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
8. To be able to design cam systems to generate specified output motion.
9. To understand the stability of sea vehicles, aircrafts and automobile vehicles and know the design of flywheel.
10. To identify the suitable governors for the particular application and to determine the unbalanced forces of reciprocating and rotating masses.

Course Outcomes:

After completion of the course the student will be able to

6. Design various types of linkage mechanisms for Obtaining specific motion and analyse them for optimal functioning.
7. Analyze the rigid link and compute the velocity and acceleration at any point in a rigid link.
8. Design the cam and follower arrangements for various applications.
9. Analyze stabilization of sea vehicles, aircrafts and automobile vehicles and design the flywheel.
10. Analyze the various governors and compute unbalanced forces of reciprocating and rotating masses.

UNIT – I: **(9 Lectures)**

MECHANISMS: Classification of mechanisms-Basic kinematic concepts and definitions-Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions- Mechanical advantage-Transmission angle-Description of some common mechanisms-Quick return mechanism, straight line generators-Universal Joint-Rocker mechanisms - Toggle Mechanism

UNIT – II: **(9 Lectures)**

VELOCITY AND ACCELERATION DIAGRAMS: Displacement, velocity and acceleration analysis of simple mechanisms - four bar and slider crank mechanisms by graphical and analytical methods - instantaneous centers - velocity and acceleration analysis using loop closure equations - dynamics-Coincident points- Coriolis component of acceleration- introduction to linkage synthesis- three position graphical synthesis for motion and path generation Introduction, force calculations using method of joints and method of sections.

UNIT – III: **(9 Lectures)**

CAMS: Classification of cams and followers-Terminology and definitions-Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers

UNIT-IV: **(9 Lectures)**

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as two wheeler and four wheeler - aero planes and ships, static and dynamic force analysis of planar mechanisms.

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams- fluctuation of energy – flywheel and their design.

UNIT – V: **(9 Lectures)**

GOVERNORS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronism and hunting.

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary and higher balancing of reciprocating masses, analytical and graphical methods, unbalanced forces and couples.

Text Books:

4. Theory of Machines by Thomas Bevan, 3rd edition, CBS Publishers & Distributors, 2005.
5. Mechanisms of Machines by Cleghorn W.L. , Oxford University Press, 2005.

Reference Books:

5. Kinematics and Dynamics of Machinery by Robert L. Norton, Tata McGrawHill, 2009.
6. Theory of Mechanisms and Machines by Ghosh A. and Mallick A.K., Affiliated East-West Pvt.
7. Mechanism and Machine Theory by JS Rao and RV Dukkipati, New Age publications.

Web References:

6. https://swayam.gov.in
7. https://www.codecogs.com
8. https://learnmechanical.com
9. https://nptel.ac.in

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

Metal Cutting & Machine Tools

Internal Marks: 40

Course Code: P18MET08 **External Marks: 60**

Course Prerequisite: Engineering workshop technology, Engineering drawing, Production Technology.

Course Objectives:

1. The course provides students with fundamental knowledge and principles in Material removal processes
2. In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc.
3. Establish the relation between shear angle and chip thickness ratio, stress and strain in the chip and cutting forces.
4. To provide information regarding the cutting tool materials and their application to different metals in metal cutting.
5. To develop fundamental knowledge on cutting fluids and tool wear mechanisms.

Course Outcomes:

After completion of the course the student will be able to

1. Analyze the concepts of metal cutting, tool life, and cutting force and chip characteristics.
2. Demonstrate the operations performed on lathe and also classify different types of Automatic Lathes.
3. Illustrate the working of milling, Shaping, slotting, planning, drilling machines Gain the knowledge of operating the mechanisms and apply machining economics.
4. Assess different levels of surface finishing operations performed on grindig process
5. Explain the working principles of jigs and fixtures & CNC machines

UNIT – I: FUNDAMENTAL OF MACHINING: (9 Lectures)

Introduction – Classification of Machining process, Machine tools, Cutting tools, Cutting conditions– geometry of single point cutting tool, tool 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, tool life, tool wear, machinability, economics of machining, coolants, tool materials and properties.

UNIT – II: LATHE MACHINES: (9 Lectures)

Engine lathe – principle of working, specification of lathe – types of lathe – work holders, tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. Turret and capstan lathes – cullet chucks – special work holders – tool geometry. Working principle and features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

UNIT – III:MILLING MACHINES : Working principles, specifications – classification of Milling Machines – horizontal, vertical and universal Milling Machines, machining operations. Types of cutters, geometry of milling cutters – methods of indexing.

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING , BORING MACHINES (11 Lectures)

Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

UNIT-IV: FINISHING PROCESSES: (8 Lectures)

Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

UNIT – V: JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

CNC MACHINE TOOLS: (9 Lectures)

CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

Text Books:

1. Production Technology by R.K. Jain and S.C. Gupta
2. Workshop Technology – B.S.Raghu Vamshi – Vol II
3. Metal cutting and machine tool engineering by Pakirappa ,Durga publishing house Hyderabad
4. Workshop Technology Vol-II by HazraChowdary,Media promoters & Publishers
5. Production Engineering by P.C. Sharma, S.Chand&Co , 2007.

Reference Books:

1. Gosh and Malik , Manufacturing Science, East west press Pv.t Ltd., 2nd EDITION, 2011.
2. J.P.Kaushish, Manufacturing Processes, PHI, Second Edition, 2010.
3. H.M.T. (Hindustan Machine Tools), Production Technology, Tata MeGraw Hill, 2009.
4. Kalpakjain S, Manufacturing Engineering & Technology, Pearson Education, 4TH edition 2001.

Web References:

1.www.metalwebnews.com
2. www.mini-lathe.com
3. www.britannica.com
4. www.machinetools.net
5. www.americanmachinist.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

DESIGN OF MACHINE MEMBERS - I

Internal Marks: 40

Course Code: P18MET13 **External Marks: 60**

Course Prerequisite: Strength of Materials

Course Objectives:

1. To analyze the basic design concepts, material selection and Apply failure theories in evaluating strength of machine elements.
2. To analyze the strength of machine components subjected to static and variable loads.
3. To analyze the design concepts and failures of riveted joints and welded joints.
4. To evaluate design of keys, joints and shafts subjected to combination of loads.
5. To analyze the design considerations of couplings and springs subjected to various load conditions.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the design procedure and selection of material for a specific application and standards.
2. Design a component when it is subjected to variable loads.
3. Design riveted and welded joints under various loading conditions.
4. Apply design concepts and material selection to keys, joints and shafts.
5. Design couplings and evaluate deformations of various springs at different loading conditions.

UNIT – I: **(9 Lectures)**

INTRODUCTION: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design, tolerances and fits –BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses – combined stresses – Torsional and bending stresses – impact stresses- Various theories of failure under static load – factor of safety – design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations – static strength design based on fracture toughness.

UNIT – II: **(9 Lectures)**

STRENGTH OF MACHINE ELEMENTS: Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – Endurance limit – Estimation of endurance strength –Factor of safety for fatigue loading- Goodman‟s line – Soderberg‟s line – Modified Goodman‟s line.

UNIT – III: **(9 Lectures)**

RIVETED JOINTS: Types of riveted heads and riveted joints - Lap Joint – Butt joint – Failure of riveted joints - Design of joints with initial stresses and efficiency - eccentric loading

WELDED JOINTS: Types of welded joints - Failure of welded joints - Design consideration of welded joints for static, varying load and eccentric loading -. Caulking and Fullering.

UNIT-IV: **(9 Lectures)**

KEYS, COTTERS AND KNUCKLE JOINTS: Classification of Keys-Design of keys-stresses in keys-cotter joints- spigot and socket, sleeve and cotter, jib and cotter joints-knuckle joints.

SHAFTS: Causes of failures, shaft material, Design of solid and hollow shafts for stiffness and rigidity – design of shafts for axial, torsion, combined loading and bending stress - Flexible shaft.

UNIT – V: **(9 Lectures)**

SHAFT COUPLINGS: Types of shaft couplings-Rigid couplings – muff, split muff and flange couplings, flexible couplings – flange coupling (modified).

MECHANICAL SPRINGS: Materials for springs, Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.

Text Books:

1. Design of Machine Elements by V.Bandari, TMH Publishers
2. A Text Book of Machine Design by R.S Khurmi & J.K Gupta
3. Machine design – Pandya & Shah

Reference Books:

1. Design of Machine Elements / V.M. Faires
2. Machine design / Schaum Series.
3. Data books (1) PSG College of technology (2) Mahadevan

Web References:

1. http://nptel.ac.in

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

THERMAL ENGINEERING - II

Internal Marks: 40

Course Code: P18MET14 **External Marks: 60**

Course Prerequisite: Thermo Dynamics,Thermal Engineering –I

Course Objectives:

The course is intended to

1. Provide the basic knowledge of components being used in steam and gas power plant.
2. Study the functions and components of steam nozzles in the steam turbines.
3. Learn Working principle and function of steam turbines.
4. Demonstrate steam condensers and gas turbines.
5. Study the principles of jet propulsion and rockets.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the basic knowledge of various types of Boilers and Draught.
2. Analyze the functions of various steam nozzles.
3. Explain the flow, velocity diagram in steam turbines.
4. Apply different methods which are involved in working of steam condensers and Gas turbines.
5. Explain the working principles of jet propulsion and rockets.

UNIT – I: **(9 Lectures)**

BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories– working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT – II: **(9 Lectures)**

STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis– assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line..

UNIT – III: **(9 Lectures)**

STEAM TURBINES: Classification - impulse turbine; mechanical details – velocity diagram – effect of friction– power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency

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 – calculation of blade height.

UNIT-IV: (9 Lectures)

STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air
pump- cooling water requirement.

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, types of combustion chambers.

UNIT – V: (9 Lectures)

JET PROPULSION : Principle of operation –classification of jet propulsive engines – working principles with schematic diagrams and representation on T-S diagram - thrust, thrust power and propulsion efficiency – turbo jet engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance
evaluation, thrust augmentation – methods.

Rockets : Application – working principle – classification – propellant type – thrust, propulsive efficiency –specific impulse – solid and liquid propellant rocket engines.

Text Books:

1. Thermodynamics and Heat Engines/ R. Yadav, Volume -II /Central Publishing House
2. Gas Turbines /V.Ganesan /TMH
3. Heat Engineering /V.P Vasandani and D.S Kumar/Metropolitan Book Company, New Delhi

References:

1. Gas Turbines and Propulsive Systems /P.Khajuria & S.P.Dubey /Dhanpatrai
2. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
3. Thermal Engineering-R.S Khurmi, &J S Gupta/S.Chand.
4. Thermal Engineering-P.L.Bellaney/ Khanna publishers.
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros. Publishers
6. Thermal Engineering / RK Rajput/ Lakshmi Publications

Web References:

1. www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.learnengineering.in
5. www.mechanical.in

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

MAINTENANCE ENGINEERING
(Professional Elective-I)

Internal Marks: 40

Course Code: P18MEE01 **External Marks: 60**

Course Prerequisite: NIL

Course Objectives:

1. To illustrate the techniques used for maintenance management and practices adapted in industry**.**
2. To develop ability in failure analysis techniques and preventive measures for maintenance.
3. To execute the knowledge in machinery and vehicle maintenance system and condition monitoring.
4. To equip the students in audit system, planning and scheduling for maintenance.
5. To understand the techniques and implementing for productive maintenance.

Course Outcomes:

The students will be able to

1. Apply the knowledge in key concepts in maintenance policies and reliability tool.
2. Analyze the technical skill in failure analysis and preventive measures.
3. The students will able to machinery and vehicle maintenance and condition monitoring.
4. Acquire knowledge about Maintenance Audit system and methodology
5. Apply the system of productive maintenance, losses and Master plan.

UNIT – I: MAINTENANCE ENGINEERINGAND MANGAEMENT (9 Lectures)

Maintenance – Basic concepts, Need of Maintenance, Maintenance Policies, Strategies and Effects of maintenance-Maintenance forms/actions and their inter relationships, descriptions of various Maintenance actions. Maintenance organization, objectives of organization design, types of organization

Reliability – Basic concepts, Bathtub curve, Failure rate, Mean time before failure. System reliability – Reliability of series and parallel systems. Markov models optimization of system Reliability

UNIT – II: FAILURE ANALYSIS & PREVENTION MEASURES (9 Lectures)

Failure Analysis (FA) - Basic Failure Mechanisms, Distortion Failures, Overload Failures. Failure Analysis Techniques-Consequence, FMEA, FMECA and FTA

Preventive Measures (PM) - Process flow, Frequency in PM**.** Types of PM -Time based, usage based. PM planning, advantage & disadvantage of PM, elements of PM for machinery and Check list.

UNIT – III: MACHINERY AND VEHICLE MAINTENANCE (9 Lectures)

Machinery Maintenance (MM)- Practices on production machines- lathe, Drilling, Milling, Shaper, Planner and CNC machine. Computerized machine monitoring system- Vibration, Speed, Temperature, pressure

Vehicle Maintenance (VM) – Need, importance, primary and secondary functions, classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures– service intervals - Towing and recovering

UNIT-IV: MAINTENANCE SYSTEM AUDIT (9 Lectures)

Maintenance Audit Methodology- ISO 19011:2018 , Maintenance Audit Objective , strategies - Organization Culture, Employee Empowerment, Materials Management, Maintenance Process Improvement, Budgeting and Cost Control, Planning and Scheduling, Maintenance Tactical Delivery. Information Technology- Computer-aided maintenance management system (CMMS), functions, applications and advantages of CMMS.

UNIT – V: TOTAL PRODUCTIVE MAINTENANCE (9 Lectures)

Definition concept of TPM, characteristics of TPM, Benefits of TPM, losses of TPM, implementing TPM. Philosophy of TPM. Indications of TPM.

TPM Development-Preparation phase, TPM introduction education, TPM Promotion Organization, TPM policies and goods, TPM Master Plan TPM initiatives,

Text Books

1. Gupta A. K., Reliability, Maintenance and Safety Engineering, University Science Press, New Delhi, 2009
2. Venkataraman, Maintenance Engineering and Management, Prentic-Hall of India Pvt. Ltd., New Delhi, 2007
3. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995

Reference Books:

1. Mishra.R.C. Pathak. K, "Maintenance Engineering and Management", Second Edition, PHI Learning, 2012
2. Tanmoy Deb, "Maintenance Management and Engineering", Ane Books Pvt. Ltd., 2011 .
3. Srivastava S. K., Maintenance Engineering and Management, S. Chand & Company Ltd., New Delhi, 1998
4. Davies, Handbook of Condition Monitoring, Chapman & Hall, 1996.
5. Rao S. S., Reliability-Based Design, McGraw-Hill, Inc, New York, 1992.

Web References:

1. www.Onlinelibrary.wiley.com
2. www.easyengineering.net
3. www.learnengineering.in
4. www.ktunotes.in
5. www.coursehero.com
6. www.onupkeep.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

MATERIAL HANDLEING
(Professional Elective - I)

Internal Marks: 40

Course Code: P18MEE02 **External Marks: 60**

Course Prerequisite: Multidisciplinary

Course Objectives:

The course is intended to

1. To understand the overall facilities planning process
2. To educate product, process and schedule design and their effects on the facility layout
3. To introduce concepts of material handling and safety in industries
4. To enable students to design material handling systems
5. Ability to apply the statistical considerations in design and analyze the defects and failure modes.

Course Outcomes:

After completion of the course the student will be able to

1. Know the environmental and economical aspects in facilities planning
2. Understand various material handling systems.
3. It explains about the different types of material handling, advantages and disadvantages. It also suggests the selection procedure for the material handling along with its specifications.
4. The material handling is explained with models, selection procedure of material handling is depending on different function oriented system. This also related with plant layout by which the minimization of the handling charges will come down.
5. The ergonomics related to material handling equipment about design and miscellaneous equipments.

UNIT – I: **(9 Lectures)**

Introduction, Material Handling systems, Material Handling Principles, Classification of Material Handling Equipment, Relationship of material handling to plant layout.

UNIT – II: **(9 Lectures)**

Basic Material Handling systems: Selection, Material Handling method- path, Equipment, function oriented systems.

UNIT – III: **(9 Lectures)**

Methods to minimize cost of material handling- Maintenance of Material Handling Equipments, Safety in handling, Ergonomics of Material Handling equipment. Design, Miscellaneous equipment.

UNIT-IV: **(9 Lectures)**

Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains hemp rope and steel wire rope, selection of ropes, fastening of hain sand ropes, different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems. Chain and rope sheaves and sprockets.

UNIT – V: **(9 Lectures)**

Load handling attachments, standard forged hook, hook weights, hock bearings, cross piece and casing of hook, crane grab for unit and piece loads, load platforms and side dump buckets, electric lifting magnets, grabbing attachments for loose materials , crane attachments for handling liquid materials.

Text Books:

1. A.W.Peymberton, Plant layout and Material Handling , John Wiley
2. James A Apple, Plant layout and Material Handling, Krieger Pub Co, 1998
3. Materials Handling Equipment-M.P. Alexandrov. Mie Publishers, Moscow.

References:

1. Aspects of Material handling-Arora
2. Introduction to Material Handling-Ray.
3. K.C.Arora & Shinde, Aspects of Material Handling, Lakshmi Publications.
4. Materials Handling Equipment-N. Rudenko, Envee Publishers, New Delhi

Web References:

1. www.nptel.com
2. www.lecturenotes.com
3.www.myclgnotes.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

OPERATIONS RESEARCH

Internal Marks: 40

Course Code: P18MEE03 **External Marks: 60**

Course Prerequisite: NIL

Course Objectives:

The course is intended to

1. Solve the linear programming problems.
2. Solve transportation and assignment problems.
3. Solve replacement problems.
4. Solve game theory, queuing problems.
5. Solve network analysis problems.s

Course Outcomes:

After completion of the course the student will be able to

1. Is able to solve the linear programming problems.
2. Is able to solve transportation and assignment problems.
3. Is able to solve replacement problems.
4. Is able to solve game theory, queuing problems.
5. Is able to solve network analysis problems.

UNIT – I: **(9 Lectures)**

Development – definition– characteristics and phases – operation research models – applications. LINEAR PROGRAMMING: problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT – II: **(9 Lectures)**

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem. **SEQUENCING** – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through ‘m’ machines.

UNIT – III: **(9 Lectures)**

REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT-IV: **(9 Lectures)**

THEORY OF GAMES: Introduction to decision theory – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

WAITING LINES: Introduction to Kendallis notation–classification of queuing models, single channel – with infinite population and finite population models– multichannel – with infinite population.

UNIT – V: **(9 Lectures)**

Network Analysis: Project planning, scheduling and controlling – tools for project management – critical path method – programme evaluation and review technique (PERT) – cost analysis and crashing – resource leveling – updating.

Text Books:

1. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers.
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

References:

1. Introduction to O.R/Hiller & Libermann/TMH
2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.
3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHI Publications.
5. Operations Research / Wagner/ PHI Publications.

Web References:

1. www.nptel.com
2. www.lecturenotes.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

ROBOTICS

Internal Marks: 40

Course Code: P18MET02 **External Marks: 60**

Course Prerequisite: Kinematics of Machinery

Course Objectives:

1. To give students practice in applying their knowledge of mathematics, science and Engineering and to expand this knowledge into the vast area of robotics.
2. To understand the basic components of robotics.
3. To understand the motion analysis and kinematic of robotics.
4. Mathematical approach to explain how the robotic arm motion can be described.
5. The students will understand functioning of sensors and actuators.

Course Outcomes:

After completion of the course the student will be able to

1. Identify various robot configurations.
2. Identify the various components of robots.
3. Carryout kinematic and dynamic analysis for simple serial kinematic chains.
4. Perform the mathematical approach for motion of robots.
5. Perform trajectory planning for a manipulator by avoiding obstacles and Select appropriate actuators and sensors for a robot based on specific application

UNIT – I: **(9 Lectures)**

INTRODUCTION: Robotics in Automation, CAD/CAM and Robotics- An over view of Robotics – Applications of Robotics – Classification by coordinate system and control system.

UNIT – II: **(9 Lectures)**

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT – III: **(9 Lectures)**

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation-problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

DYNAMICS: Differential transformation and manipulators, jacobians- problems Dynamics-Lagrange- Euler and Newton – Euler formulations – Problems.

UNIT-IV: **(9 Lectures)**

General considerations in path description and generation. Trajectory planning and Avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – robot programming, languages and software packages – description of paths with a robot programming language.

UNIT-V: **(9 Lectures)**

ROBOT ACTUATORS AND FEEDBACK COMPONENTS: Actuators: Pneumatics, Hydraulic actuators, Electric and stepper motors. Feedback components: Position sensors – potentiometers, resolvers, encoders – velocity sensors.

Text Books:

1. Industrial Robotics by Groover, M P/Pearson edu.
2. Robotics and Control by Mittal R K & Nagrath I J, TMH Publishers

Reference Books:

1. Robotics by Fu K S, McGraw Hill Publishers.
2. Robotic Engineering by Richard D. Klafter, Prantice Hall publishers.
3. Robot Analysis and Control by H.Asada and J.J.E. Slotine, BSP Books pvt. Ltd.
4. Introduction to Robotics by John J. Craig, Pearson Edu.

Web References:

1. https://www.iare.ac.in
2. https://www.millibar.com
3. https://www.coursehero.com
4. https://link.springer.com
5. https://www.ulektzbooks.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

INDUSTRIAL ENGINEERING & MANAGEMENT

(OPEN ELECTIVE-1)

Internal Marks: 40

Course Code: P18MEO01 **External Marks: 60**

Course Prerequisite: Engineering Mathematics, Physics

Course Objectives:

1. To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering
2. To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.
3. To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.
4. To enable students to understand their role as engineers and their impact to society at the national and global context.

Course Outcomes:

Upon successful completion of this course the student will be able to:

1. Design and conduct experiments, analyze, interpret data and synthesize valid conclusions
2. Design a system, component, or process, and synthesize solutions to achieve desired needs
3. Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints
4. Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management

UNIT – I: **(9 Lectures)**

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

UNIT – II: **(9 Lectures)**

PLANT LAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

UNIT – III: **(9 Lectures)**

OPERATIONS MANAGEMENT: Importance, types of production, applications, work-study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs,

UNIT-IV: **(9 Lectures)**

STATISTICAL QUALITY CONTROL: Quality control, its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – X and R – charts X AND S charts and their applications, numerical examples.

TOTAL QUALITY MANAGEMENT: zero defect concept, quality circles, implementation, applications, ISO quality systems. six sigma – definition, basic concepts

UNIT – V: **(9 Lectures)**

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types. Value engineering, implementation procedure, enterprise resource planning and supply chain management.

PROJECT MANAGEMENT: PERT, CPM – differences & applications, critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

Text Books:

1. Industrial Engineering and management / O.P Khanna/Khanna Publishers.
2. Industrial Engineering and Production Management/Martand Telsang/S.Chand & Company Ltd. New Delhi

Reference Books:

1. Industrial Management / Bhattacharya DK/Vikas publishers
2. Operations Management / J.G Monks/McGrawHill Publishers.
3. Industrial Engineering and Management Science/ T. R. Banga, S. C. Sharma, N. K. Agarwal/Khanna Publishers
4. Principles of Management /Koontz O' Donnel/McGraw Hill Publishers.
5. Statistical Quality Control /Gupta/Khanna Publishers
6. Industrial Engineering and Management /NVS Raju/Cengage Publishers

Web References:

1. www. nptel.ac.in
2. www.smartzworld.com
3. www.me-mechanicalengineering.com

B.Tech. III Year I Semester

Course Structure

L	T	P	C
3	0	0	3

MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)
(OPEN ELECTIVE-1)

Internal Marks: 40

Course Code: P18MEO01 **External Marks: 60**

Course Prerequisite: Engineering Mathematics, Physics

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, bioand chemical systems.
4. To learn Microsystems Technology analyzation for technical feasibility as well as practicality.
5. To learn Magnetic sensing, detection and Radio Frequencies.

Course Outcomes:

1. Students able to know the importance and various devices of MEMS And Their Applications
2. Describe new applications and directions of modern engineering.
3. Describe the techniques for building micro devices in silicon, polymer, metal and other materials.
4. Describe the physical, chemical, biological, and engineering principles involved in the design and operation of current and future micro devices.
5. Critically analyze Microsystems technology for technical feasibility as well as practicality.

Unit – I **(9 Lectures)**

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 **(9 Lectures)**

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 **(9 Lectures)**

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.

Unit – IV **(9 Lectures)**

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, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

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 **(9 Lectures)**

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.

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:

MEMS, Nitaigour Premchand Mahalik, TMH Publishing co.

REFERENCE BOOKS:

1. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.
2. MEMS and NEMS, Sergey Edwrd Lyshevski, CRC Press, IndianEdition.
3. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu,TMH Publishers.
4. Introductory MEMS, Thomas M Adams, Richard A Layton, SpringerInternational Publishers.

Web References:

1. www. nptel.ac.in
2. www.smartzworld.com
3. www.me-mechanicalengineering.com

B.Tech. III Year I Semester **Course Structure**

	L	T	P	C
DATABASE MANAGEMENT SYSTEMS	**3**	**0**	**0**	**3**

Internal Marks: 40

Course Code: P18CSO03 **External Marks: 60**

Course Prerequisite: NIL

Course Objectives:

- Provides students with theoretical knowledge
- Practical skills in the design use of databases and database management systems in information technology applications.

Course Outcomes:

- Acquire knowledge in fundamentals of DBMS and identify the differences between traditional file system and DB systems.
- Understand various DBMS models and how queries are being processed and executed in RDBMS.
- Understand of database, tables and key constraints.
- Analyze DB design methodology and normalization process.
- Discuss various files indexing techniques.

UNIT I: **(6 Lectures)**

INTRODUCTION: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and Data independence; Three tier schema architecture for data independence; Database system structure.

UNIT II: **(6 Lectures)**

ENTITY RELATIONSHIP MODEL: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

RELATIONAL MODEL: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints and their importance.

UNIT III: **(6 Lectures)**

BASIC SQL : Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, views.

UNIT IV: **(6 Lectures)**

SCHEMA REFINEMENT (NORMALIZATION): Problems Caused by Redundancy, Decompositions, Problems Related to Decomposition, Functional dependency, Properties of

Functional dependency, Properties of Decompositions - Lossless join decomposition and dependency preserving decomposition, Normal forms based on functional dependency - 1NF, 2NF and 3NF, Boyce-Codd normal form(BCNF).

UNIT V: (6 Lectures)

OVERVIEW OF STORAGES AND INDEXING: Data on External Storage- File Organization and Indexing – Clustered Indexing – Primary and Secondary Indexes, Index Data Structures.

Text Books:

1. Database Management Systems, 3/e Raghuram Krishnan, Johannes Gehrke, TMH,2002.
2. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA,2010.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning,2012.
4. Database Management Systems,Rajesh Narang,Second Edition,2018.

References:

1. Database System Concepts. 5/e Silberschatz, Korth, TMH,2002.
2. Introduction to Database Systems, 8/e C J Date, PEA,2000.
3. The Database book principles & practice using Oracle/MySql Narain Gehani, University Press,2008.

Web References:

1. www.academy.vertabelo.com
2. www.w3schools.com
3. www.codecademy.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
2	0	0	2

Object Oriented Programming through JAVA

Subject Code: P18CSO02 **Internal Marks: 40**
External Marks: 60

Course Prerequisites: Object-Oriented Programming

Course Objectives:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To understand the principles of packages, inheritance and interfaces
- To Implement exceptions and use I/O streams
- To design and build simple Graphical User Interface application.

Course Outcomes:

- Implement OOPS concepts in Java programs
- Develop Java programs with the concepts of inheritance and interfaces
- Design a Java applications using exceptions and I/O streams
- Design interactive Java application using swings

UNIT I **(6 Lectures)**

OOPS-Fundamentals- Object Oriented Programming concepts - Abstraction - objects and classes - Encapsulation- Inheritance -Polymorphism- OOP in Java - Characteristics of Java-Java Source File -Structure- Compilation- Data Types - Variables and Arrays - Operators - Control Statements.

UNIT II **(6 Lectures)**

Inheritance and Interface Classes-Objects-Methods-constructors-Inheritance-polymorphism-Access specifier- Static members-Abstract classes-Interfaces.

UNIT III **(6 Lectures)**

Exception Handling ane Packages Exception handling -try-catch, throw, throws, finally block, user defined exception- built-in exceptions-Packages and Inner classes-Array Lists - Strings.

UNIT IV **(6 Lectures)**

Files and Concurrent Programming--Input -Output Basics - Streams - Byte streams and Character streams - Reading and Writing Console - Reading and Writing Files.Multi-threaded programming - thread life cycle- interrupting threads - thread states - thread priorities- thread synchronization- Inter-thread communication.

UNIT V **(6 Lectures)**

Graphics Programming- Applets- Applet class, Applet structure, An Example Applet Program, Applet Life Cycle - Frame - Components- java.awt package, Layouts, Basics of event handling - event handlers -AWT event hierarchy - Swing Components- Text Fields, Text Areas - Buttons- Check Boxes – Radio Buttons - Lists- choices- Scrollbars - Windows -Menus - Dialog Boxes.

Text Books:

1. Java The complete reference, 8th Edition, Herbert Schildt, McGraw Hill Education, 2011.
2. Core Java Volume-I Fundamentals, 9th edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, 2013.

Reference Books:

1. Java 2 Black book, Steven Holzner, Dream tech press, 2011.
2. The JAVA programming language, Third edition, K. Arnold and J. Gosling, Pearson Education, 2000.
3. An introduction to Object-oriented programming with Java, Fourth Edition, C.Thomas Wu, Tata McGraw-Hill Publishing company Ltd., 2006.

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1. www.tutorialspoint.com
2. www.beginnersbook.com
3. www.w3schools.com
4. www.udemy.com

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

Machine Tools Lab

Internal Marks: 40

Course Code: P18MEL06 **External Marks: 60**

Course Prerequisite: Engineering workshop.

Course Objectives:

To understand the parts of various machine tools, operations and make the different shapes of components that can be produced on these machine tools.

Course Outcomes: Upon successful completion of the course the student can

1. Analyze and select the suitable machine to perform the machining operation.
2. Apply the practical skill in making a component using different operations of lathe.
3. Develop the grooved components using milling, shaper and slotter machines.
4. Develop the smooth machined surfaces and cutting tools using grinding machines.
5. Build the various drilled and tapped components

List of Experiments:

1. Study of general purpose machines -lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Perform Step turning and taper turning on lathe machine.
3. Perform Thread cutting and knurling on lathe machine.
4. Perform Drilling and boring on lathe.
5. Perform Drilling and tapping in different dimensions.
6. Perform Shaping and planning on the work piece.
7. Perform internal Slotting on the work piece.
8. Perform grooving operation using Milling machine on the work piece.
9. Perform Cylindrical surface grinding on the work piece.
10. Perform grinding of tool angles using tool and cutter grinder.

B.Tech. III Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

DYNAMICS OF MACHINERY LAB

Internal Marks: 40

Course Code: P18MEL08 **External Marks: 60**

Course Prerequisite:

Course Objectives:

1. Study various types of force systems, basic principles of mechanics of rigid bodies and Calculation the unknown forces through the use of equilibrium equations for a rigid body.
2. Analyze simple trusses using method of joints and method of sections.
3. Study and determine centroids and centre of gravity of various composite shapes.
4. Study the concept of moment of inertia and the mathematical calculations involved in finding moment of inertia of two dimensional areas.
5. Learn principle of dynamics and apply it to impulse and momentum, work and energy which is useful to analyze turbo machineries.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the principle of rigid body equilibrium and to determine unknown forces.
2. Analyze the force of friction and trusses using method of Joints and method of sections.
3. Find the centroids and center of gravity of composite areas.
4. Calculate the moment of inertia of various shapes by integration and moment of inertia of composite areas.
5. Understand kinematics, kinetics and rotation of a rigid body.

LIST OF EXPERIMENTS

1. Determine whirling speed of shaft theoretically and experimentally.
2. Determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. Determine the gyroscopic effect with respect to various loads and speeds.
4. Determine the frequency of undamped free vibration of an equivalent spring mass system.
5. Determine the frequency and damping coefficient of damped force vibration of a spring mass system.
6. Study the static and dynamic balancing using rigid blocks.
7. Find the moment of inertia of a flywheel axle system.
8. Draw the cam profile of various cam and follower.
9. Draw the displacement, velocity and acceleration diagram against crank rotation for single slider crank mechanism.
10. Find coefficient of friction between belt and pulley.
11. Study simple and compound screw jack and determine the mechanical advantage , velocity ratio and efficiency.

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

INSTRUMENTATION AND CONTROL SYSTEMS

Internal Marks: 40
External Marks: 60

Course Code: P18MET12
Course Prerequisites: Engineering Physics, BEEE

Course Objectives:

1. To learn about principles of measurement and functions of various measuring instruments
2. To demonstrate the various instruments used for measuring temperature and pressure.
3. To know how about different methods for measuring of levels, flows and speed measurements.
4. To understand about various types of gauges for stress-strain measurement and humidity measurement.
5. To get an idea about various devices for measurement of torque, force and various elements of control systems.

Course Outcomes: Upon successful completion of the course the student can

1. Apply practical knowledge in principle of measurement and functions of various instruments for measuring application.
2. Develop an idea in various instruments used for temperature measurements and pressure measurement.
3. Measure the various instruments used for measurement of flow, speed and vibration.
4. Examine the various devices for humidity measurement and stress strain gauges.
5. Apply the practical skill in measurement of torque, force and functions of control systems.

UNIT – I **(9 Lectures)**

PRINCIPLES OF MEASUREMENTS: Definition – Basic principles of measurement – measurement systems, generalized configuration and functional descriptions of measuring, instruments – examples. dynamic performance characteristics – sources of error, classification and elimination of error.

Measurement of Displacement: Working principles and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

UNIT – II **(9 Lectures)**

MEASUREMENT OF TEMPERATURE: Classification – ranges –various principles of measurement – expansion, electrical resistance –thermistor – thermocouple – pyrometers – temperature indicators.

MEASUREMENT OF PRESSURE: Units – classification – different principles used. manometers, bourdon pressure gauges, bellows –diaphragm gauges. low pressure measurement – thermal conductivity gauges – ionization pressure gauges, McLeod pressure gauge - different types of pressure sensors.

UNIT – III **(9 Lectures)**

MEASUREMENT OF LEVEL : Direct method – indirect methods –capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubbler level indicators.

FLOW MEASUREMENT: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser doppler anemometer (LDA).

MEASUREMENT OF SPEED : Mechanical tachometers – electrical tachometers – stroboscope, noncontact type of tachometer

Measurement of Vibration: Different simple instruments– principles of seismic instruments – vibrometer and accelerometer using this principle.

UNIT – IV **(9 Lectures)**

STRESS STRAIN MEASUREMENTS: Various types of stress and strain measurements – 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 HUMIDITY – Moisture content of gases, sling psychomotor, absorption psychomotor, dew point meter.

UNIT – V **(9 Lectures)**

MEASUREMENT OF FORCE, TORQUE AND POWER- Elastic forcemeters, load cells, torsion meters, dynamometers.

ELEMENTS OF CONTROL SYSTEMS : Introduction, importance –classification – open and closed systems, servomechanisms–examples with block diagrams–temperature, speed & position control systems, fuzzy logic control systems.

TEXT BOOKS

1. Measurement Systems: Applications & design by D.S Kumar.
2. Mechanical Measurements / Beck With, Marangoni, Linehard, PHI /PE.

REFERENCES:

1. Measurement systems: Application and design, Doeblin Earnest. O.Adaptation by Manik and Dhanesh/ TMH.
2. Experimental Methods for Engineers / Holman.
3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers
4. Instrumentation, measurement & analysis by B.C.Nakra & K.K.Choudhary, TMH.

Web References:

1. www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

HEAT AND MASS TRANSFER

Internal Marks: 40

Course Code: P18MET13 **External Marks: 60**

Course Prerequisites: Thermodynamics

Course Objectives:

1. To apply the concept of steady state heat conduction encounter.
2. To apply the concept of heat transfer rate in extended surfaces and transient heat conduction with respect to time.
3. To apply the heat transfer in condensation, boiling systems and analyze the performance of heat exchangers.
4. To solve the free, forced convection heat transfer problems.
5. To illustrate the concept of radiation heat transfer between two bodies and mass transfer.

Course Outcomes: Upon successful completion of the course the student can

1. Evaluate the amount of heat transfer in 1-Dimensional steady state heat conduction.
2. Compute the concept of Temperature distribution through fins and Analyze the 1-Dimesional steady state transient heat conduction equations.
3. Estimate the heat exchanger performance, analyze the various regimes in boiling and condensation.
4. Analyze free and forced convection of heat transfer problems using different empirical correlations.
5. Examine the concept of radiation heat transfer and mass transfer.

UNIT – I

Introduction to Heat Transfer: (9 Lectures)

Modes and mechanisms of heat transfer-General Differential equation of Heat Conduction– Cartesian and Polar Coordinates.

One Dimensional Steady State Heat Conduction– plane and Composite Systems– overall heat transfer coefficient– critical radius of insulation – Conduction with Internal Heat Generation.

UNIT – II

One Dimensional Transient Conduction Heat Transfer: (9 Lectures)

Fins– Extended Surfaces – Unsteady state Heat Conduction– Lumped system Analysis-Semi Infinite and Infinite Solids – Use of Heisler's charts.

UNIT – III

Phase Change Heat Transfer: (9 Lectures)
Regimes of Boiling Curve–Nucleate Boiling and Film Boiling – Film wise and drop wise condensation –Nusselt's theory of condensation on vertical and horizontal plates using empirical correlations.

Heat Exchangers: Classification of heat exchangers – Concepts of LMTD and Effectiveness - NTU methods - Compact Heat Exchangers - types - problems.

UNIT – IV

Convective Heat Transfer: (09 Lectures)
Dimensional analysis– Buckingham Pi theorem for forced and free convection, application for developing semi – empirical non- dimensional correlation for convective heat transfer.
Free and Forced Convection:
Concepts about Hydrodynamic and Thermal Boundary Layer – Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes.

UNIT – V

Radiation: (09 Lectures)
Heat exchange between two black bodies – concepts of shape factor – heat exchange between grey bodies – radiation shields–Electrical Analogy.

Mass Transfer: Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.

TEXT BOOKS

1. Heat Transfer/JPHOLMAN/TMH
2. Heat and Mass Transfer/Aroraand Domkundwar/Dhanpatrai&sons
3. Heat Transfer/P.K.Nag/TMH
4. Principles of Heat Transfer/ Frank Kreith, RM Manglik & MS Bohn/Cengage learning publishers

REFERENCES:

1. Fundamentals ofEngg.Heat and Mass Transfer/R.C.Sachdeva/ New Age International.
2. Heat and Mass Transfer/Cengel/McGraw Hill.
3. Heat and Mass Transfer/D.S.Kumar/ S.K.Kataria&Sons
4. A Text book on Heat Transfer-4thEdition/ S.PSukhatme/Universities Press

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1. www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

POWDER METALLURGY
(Professional Elective-II)

Internal Marks: 40

Course Code: P18MEE05 **External Marks: 60**

Course Prerequisites: Metallurgy and Materials Science

Course Objectives:

1. To introduce the concepts of powder metallurgy with special reference to recent development of powder metallurgy products.
2. 2.This course teaches powder preparation, characterization, compaction and sintering.
3. Acquire the knowledge of Powder Characterization: Powder conditioning.
4. 4.Student able to Basic aspects, types of compaction presses.
5. Acquire the knowledge of Sintering techniques and Sintered Products.

Course Outcomes: Upon successful completion of the course the student can

After completion of the course the student will be able to

1. Acquire the knowledge of Powder Metallurgy History, Applications and its importance.
2. Acquainted the knowledge of metal powder production methods.
3. Aware about the powder characterization techniques.
4. Familiar about basic methods of Powder compaction for green compact.
5. Explain various powder forming techniques other than the compaction, mechanism of sintering and types sintering for development of mechanical properties.

UNIT – I

Introduction: **(9 Lectures)**

Introduction and modern developments in Powder Metallurgy. Advantages, limitations and applications of Powder Metallurgy. Basic Steps for Powder Metallurgy.

Characteristics of metal powder: Chemical composition, Particle size, shape and size distribution, Characteristics of powder mass such as apparent density, tap density,.

UNIT – II **(9 Lectures)**

Metal powder production methods: Atomization, Reduction from oxide, Electrolysis, Crushing, Milling, Condensation of metal vapour, Hydride and carbonyl processes, Mechanical Alloying, New developments.

UNIT – III **(9 Lectures)**

Powder Characterization: Powder conditioning, fundamentals of powder compaction, density distribution in green compacts, compressibility, green Strength, pyrophorocity and toxicity.

UNIT – IV **(9 Lectures)**

Powder Compaction Methods: Basic aspects, types of compaction presses, compaction tooling and role of lubricants, Single and double die compaction, isostatic pressing, hot pressing.

UNIT – V **(9 Lectures)**

Sintering: Definition, stages, effect of variables, sintering atmospheres and furnaces, Mechanism, liquid-phase sintering, Secondary operations.

Sintered Products: Study of sintered bearings, cutting tools, metallic filters, friction and antifriction parts and electrical contact materials. Defects in Powder metallurgy processed materials and their processing.

TEXT BOOKS

1. Introduction to Powder Metallurgy, A. K. Sinha, Dhanpatrai Publication
2. Powder Metallurgy: Science, Technology, and Materials, Anish Upadhyaya, Gopal Shankar Upadhyaya, CRC Press
3. Powder Metallurgy: Science, Technology and Applications, P. C. Angelo, R. Subramanian
4. Powder Metallurgy, W.D.Jones
5. Principles of Powder Metallurgy, T.Shukerman
6. Handbook of Powder Metallurgy :- H.H.Hausner
7. Powder Metallurgy, ASM Handbook, Vol-VII.
8. German R.M., Powder Metallurgy and Particulate Materials Processing, MPIF. 2005
9. 9.Masuda H., Powder Technology Handbook, Taylor & Francis 2006
10. Sands R.L. and Shakespeare C.R., Powder Metallurgy Practice and Applications, Newness Publication 1970
11. Powder Metal Technologies and Applications, Metals Handbook, Vol.7, 9th edition, ASM 1989
12. Upadhyaya G.S., Powder Metallurgy Technology, Cambridge Press 1996

REFERENCES:

1. Sinha A. K., "Powder Metallurgy", Dhanpat Rai & Sons. New Delhi, 1982.
2. R.M. German, "Powder Metallurgy and Particulate Materials Processing", Metal Powder Industries Federation, Princeton, NJ, 2005.

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2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

AUTOMATION IN MANUFACTURING
(Professional Elective - II)

Internal Marks: 40

Course Code: P18MEE06 **External Marks: 60**

Course Prerequisites: Industrial engineering and Manufacturing technology concepts

Course Objectives:

1. Understand the basic principles of automation and tool transfer, implementation of automated flow line.
2. Understand design aspects and analysis of material handling system.
3. Understand ways of improving line balance and solving line balancing problems.

Course Outcomes: Upon successful completion of the course the student can

1. Implement concepts of a productive system in automation.
2. Apply the concepts of automated flow lines and design technologies.
3. Apply it in material handling systems for balancing assembly lines.

UNIT – I **(9 Lectures)**

Fundamentals of Manufacturing Automation: Basic Principles of automation, Types of automated systems, Degrees of automation, Automation - reasons, Production operations and automation strategies, Plant Layout, Production concepts and mathematical models, Design the parts for automation, Automatic loading Systems.

UNIT – II **(9 Lectures)**

High Volume Production Systems: Automated flow lines, Methods of work flow, Transport transfer mechanisms, buffer storage, Control functions, Automation for machining operations, Design and fabrication considerations.

UNIT – III **(9 Lectures)**

Analysis of Automated Flow Lines: Analysis of transfer lines without storage, Partial automation, Automated flow lines with storage buffers, Implementation of automatic flow lines, Line balancing problems, Considerations in assemble line design.

UNIT – IV

Assembly Systems and Line Balance: (9 Lectures)
Manual assembly lines, Line balancing problem, Methods of line balancing, Ways to improve line balancing, Flexible manual assembly lines, automated assembly systems, Analysis of multi station assembly. Manufacturing Cells, Automated Cells, Analysis of Single Station Cells

UNIT – V

Automated Material Handling: (9 Lectures)
Types of equipment and functions, Design and analysis of material handling system, Conveyor system, Automated guided vehicle system, Components operation, Types, Design of automated guided vehicles and applications, **Automated storage and Retrieval systems** - Types, Basic components and Applications, Design for Automated Assembly, Communication Systems in Manufacturing

TEXT BOOKS

1. Mikell P. Groover, ―Automation, Production Systems and CIM‖, PHI Pvt., Ltd., 1998 2. P. Radha Krishnan & S.Subrahamanyarn and Raju, ―CAD/CAM/CIM‖, New Age International Publishers, 2003. 3. Singh, ―System Approach to Computer Integrated Design and Manufacturing‖, John Wiley 1996.
2. T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall, 1996.

REFERENCES:

1. Automation, production systems and computer integrated manufacturing/ Mikell.P Groover/PHI/3rd edition/2012
2. Automation, Production Systems and CIM/ MikeJ P. Grower/PHI
3. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahamanyarn and Raju/New Age International Publishers/2003.
4. Svstem Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
5. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009

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3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

FOUNDRY TECHNOLOGY
(Professional Elective-II)

Internal Marks: 40

Course Code: P18MEE07 **External Marks: 60**

Course Prerequisite: Materials Science and Production Technology

Course Objectives:

1. Understanding the importance of foundry practice and usage of modern tools in metal casting as one of the important manufacturing processes.
2. Analyze about design concepts in gating systems and core making process.
3. Know about ferrous/ nonferrous materials casting properties and difficulties in casting and the process of solidification.
4. An overview of the designing of molds, casting defects, inspection, testing of castings and special casting process used in foundry sectors.
5. Understand how the modernization and mechanization of foundry can be achieved.

Course Outcomes:

After completion of the course the student will be able to

1. Understand the role of importance and usage of casting techniques in manufacturing sector.
2. Illustrate the design of defect-free castings considering proper gating and risering
3. Appraise about solidification process in castings and explain various melting processes.
4. Discuss about advanced casting process and their testing to meet the newer requirements.
5. Identify the needs for mechanization of foundry industries.

UNIT – I: **(9 Lectures)**

Trends & scope in foundry Industry: Position of foundry industry worldwide and in India, analysis of data in respect of production and demand, recent trends in quality specifications like dimensional accuracy, surface finish and property requirements, specifications, properties and applications of modern cast alloys.

Design considerations in manufacturing of patterns and dies: Computer Aided pattern design and manufacture, pattern making machines and equipments, Computer aided design of dies in die casting and centrifugal casting, materials used and allowances in patterns and dies.

UNIT – II: **(9 Lectures)**

Modern molding and core making processes and equipments: Various types of sands used for moulding and core making, testing of sand, high pressure line molding, Dissamatic, chemically bonded sands; shell molding binder, hardener and type of sand used in shell molding, procedure

used for making shell sand, plants used, properties and tests on shell sand, advantages and applications; Resin bonded sands, alkyl resins, phenolic resins and furnace sands, cold box method of core making – advantages and applications, ceramic molding, vacuum molding, sand reclamation – importance, methods and plants.

UNIT – III: (9 Lectures)

Melting practices and furnaces for ferrous and non- ferrous alloys: Melting practices of Al-alloys, Mg – alloys, Cu – based alloys and Ti- based alloys and SG Iron; Degassing process and methods in Al – alloys, modification treatment in Al- alloys, use of covering fluxes to avoid oxidation; Furnaces used - oil and gas fired furnaces, induction furnaces, vacuum melting and re-melting processes; Principle of working of thermocouples and spectrometers– applications; energy saving in melting practices.

Principles of Solidification: Nucleation kinetics, fundamentals of growth, solidification of single-phase alloys, solidification of eutectic alloys, solidification of peritectics.

UNIT-IV: (9 Lectures)

Quality Control in Foundries: Quality specifications in respect of raw materials used in foundry sand, sand additives, furnace charging material, alloys; Q.C. checklists maintained for raw materials, Q.C. checklists for mould – core properties; Heat wise pouring reports, details of melting log sheets, test bars, calibration records of testing equipment's (U.T.M., Sand testing equipment); Results of chemical analysis, mechanical properties, test reports, rejection report analysis, defect diagnosis, remedies, use of cause - effect or fish- bone diagrams, Application of S.Q.C. in foundries, control charts

UNIT – V: (9 Lectures)

Mechanization in Foundries: Conveying systems – sand bins, belt conveyors, roller conveyors, bucket elevators; Pouring systems – monorail, auto pour systems; sand plants, practical aspects, layout and mechanization.

Productivity improvement techniques and cost analysis in foundries: Auditing in foundries, optimization techniques, costing of castings; techniques of productivity improvement like value engineering, JIT, TPM, importance and implementation of ISO and QS in foundries

Text Books:

1. Richard. W. Heine and Rosenthal, *"Principles of Metal Castings"*, TMH, 2nd Edition, 2001.
2. P.L. Jain , "Principles of Foundry Technology", P.L. Jain (TMH)
3. O.P. Khanna, *"A Text Book of Foundry Technology"*, DhanpatRai& Sons, 15th Edition, 2011.
4. P.N. Rao, *"Manufacturing Technology",* TMH, 5th Edition,2013.

Reference Books:

1. Advanced Pattern Making – Cox I.I. (The Technical Press, London.)
2. ASM Handbook: Volume 15: Casting" 9th Ed., American Society of Metals, Ohio, 2008.

3. Metal Castings – Principles & Practice - T.V. RamanaRao. (New Age International Pvt. Ltd. Publishers.)
4. AFS and Control hand book – AFS.
5. Mechanization of Foundry Shops – Machine Construction - P.N. Aeksenov (MIR)
6. Fundamentals of Metal Casting Technology - P.C. Mukherjee (Oxford, IBH)
7. Foundry Engineering – Taylor, Fleming &Wulff (John Wiley)
8. **Castings,** John Campbell, Second edition, Elseivier, 2004
9. Foundry Technology P.R. Beelely Butterworth

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1. www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.indianfoundry.org

B.Tech III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

PRODUCTION PLANNING AND CONTROL
(Professional Elective - II)

Internal Marks: 40

Course Code: P18MEE08 **External Marks: 60**

Course Prerequisite: Operation Research, IEM.

Course Objectives:

1. Demonstrate the concepts of production and service systems
2. The ability to apply principles and techniques in the design, planning and control of these systems to optimize/make best use of resources in achieving their objectives.
3. Identify different strategies employed in manufacturing and service industries to plan production and control inventory.
4. Measure the effectiveness, identify likely areas for improvement,
5. develop and implement improved planning and control methods for production systems.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the systems concept for the design of production and service systems.
2. Describe forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques.
3. Evaluate the principles and techniques for planning and control of the production and service systems
4. To Analyze/correlate the best use of resources.
5. Justify the importance and function of inventory. Demonstrate the selected techniques for its control and management under dependent and independent demand circumstances.

UNIT-I **(9 Lectures)**

INTRODUCTION: Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department – Product design factors – Process Planning sheet.

UNIT-II **(9 Lectures)**

FORECASTING – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques– qualitative methods and quantitative methods.

UNIT-III **(9 Lectures)**

INVENTORY MANAGEMENT: Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems.

Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts, Introduction to supply chain management.

UNIT-IV **(9 Lectures)**

ROUTING: Definition – Routing procedure – Route sheets – Bill of material – Factors affecting routing procedure. Scheduling – definition –Difference with loading.
SCHEDULING POLICIES: Techniques, Standard scheduling methods.
Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects.

UNIT-V **(9 Lectures)**

DISPATCHING: Activities of dispatcher – Dispatching procedure –follow up – definition – Reason for existence of functions – types of follow-up, applications of computer in production planning and control.

TEXT BOOKS:

1. Elements of Production Planning and Control / Samuel Eilon / Macmillan Publishers
2. Modern Production and operation managements / Baffa & Rakesh Sarin / John Wiley Publishers
3. Operations Management / Joseph Monks / McGraw-Hill Ryerson Publishers

REFERENCES:

1. Operations Management / S.N. Chary/ TMH Publishers
2. Reliability Engineering & Quality Engineering / Dr. C. Nadha Muni Reddy and Dr. K.Vijaya Kumar Reddy / Galgotia Publications, Pvt., Limited.
3. Production Control A Quantitative Approach / John E. Biegel/ Prentice-Hall

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2. www.emaraldinsight.com
3. www.tandfonline.com
4. www.sartrex.ca

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

DESIGN OF MACHINE ELEMENTS-II

Internal Marks: 40

Course Code: P18MET14 **External Marks: 60**

Course Prerequisite: Strength of Materials

Course Objectives:

1. To analyze the design of Various bearings with respect to loads and selection of suitable bearings.
2. To design IC engine main components.
3. To evaluate the design of screws and various power transmission systems.
4. To design curved beams of various cross sections.
5. To design various types of gears and failures.

Course Outcomes:

After completion of the course the student will be able to

1. Design the suitable bearing based on the application of the loads and predict the life of the bearing.
2. Design the engine parts like piston, connecting rod and crankshaft.
3. Apply the design concepts to screws and mechanical transmission system.
4. Evaluate stresses in the curved beams with different cross section.
5. Apply the Design concepts for the spur and helical gear.

UNIT – I: **(9 Lectures)**

BEARINGS: Classification and selection of bearings- applications, types of journal bearings – lubrication – Petroff‟s Equation– bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT – II: **(10 Lectures)**

ENGINE PARTS: Connecting Rod: Materials for connecting rod and design of connecting rod – Crank shafts: Types of crank shafts, design of crank shafts – crank pins. Pistons - Design of pistons - structural and thermal.

UNIT – III: **(9 Lectures)**

DESIGN OF POWER SCREWS: Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, Screw Jack.

Power transmissions systems:

Transmission of power by belt and rope drives, transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives. Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums.

UNIT-IV: **(8 Lectures)**

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section, design of crane hooks, C –clamps.

UNIT – V: **(9 Lectures)**

Design of Gears: Types of gears - selection of material - Design of Spur gears and helical gears – load concentration factor – dynamic load factor, surface compressive, bending strength - Tooth wear and failure analysis.

Text Books:

1. Machine Design/V.Bandari/TMH Publishers 2015.
2. Machine Design/T.V. Sundararajamoorthy/N. Shanmugam
3. Design Data Book/PSG College of Technology 2012
4. Machine Design Data Book by S.Md.Jalaludeen.

Reference Books:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Machine Design, Volume-1 & 2 by S.Md.Jalaludeen.

Web References:

1. www. nptel.ac.in

B.Tech III Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

METROLOGY & MEASUREMENTS

Internal Marks: 40

Course Code: P18MET15 **External Marks: 60**

Course Prerequisite: Engineering Mathematics, Physics

Course Objectives:

1. To build the knowledge in limits, fits and tolerances measurement.
2. To develop knowledge on different standards of length, calibration of End Bars, linear and angular measurements**.**
3. To make use of optical measuring instruments, interferometer and Coordinate measuring machines.
4. To measure the Screw thread, gear profile using various measuring instruments.
5. To Learn principle of Machine tool testing to evaluate machine tool quality**.**

Course Outcomes:

After completion of the course the student will be able to

1. Examine the tolerances, limits of size, fits of geometrical components.
2. Measure the linear and angular measurements of components by using various types of gauges and calibration of instruments.
3. Measure specified dimensions of components by using optical measuring instruments, interferometer and Coordinate measuring machines.
4. Apply the knowledge to choose appropriate method and instruments for inspection of various gear, thread elements and also using optical instruments.
5. Examine the machine tools by alignment test and can do flatness measurement.

UNIT-I **(9 Lectures)**

SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, fits –Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, determistic & statistical tolerances, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning, precision, accuracy and error measurements.

UNIT-II **(9 Lectures)**

LINEAR MEASUREMENT: Length standards, end standards, slip gauges calibration of the slip gauges, dial indicators, micrometer, steel rule, calipers**.**

MEASUREMENT OF ANGLES AND TAPERS: Different methods – bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers, angle plate.

LIMIT GAUGES: feeler gauge**,** Taylor's principle – design of goes and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

UNIT-III **(9 Lectures)**

OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope and uses - autocollimators, optical projector, optical flats and their uses.

INTERFEROMETRY:
Interference of light, interference bands, Michelson's interferometer, NPL flatness interferometer, and NPL gauge interferometer.

ADVANCE MEASUREMENTS: Basic concept of CMM - types of CMM - software and applications - telescope gauge.

UNIT-IV **(9 Lectures)**

GEAR MEASUREMENT: Types of gears**,** measurements of gear tooth profile - gear tooth vernier & flange micro meter - total composite error and tooth to tooth composite errors, rolling gear tester, involute profile checking by profile projector.

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads- concept of virtual effective diameter, measurement of effective diameter, angle of thread and thread pitch, and profile thread gauges, screw pitch gauge.

COMPARATORS: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses thread & beam comparators and their uses.

UNIT – V **(9 Lectures)**

FLATNESS MEASUREMENT:
Measurement of flatness of surfaces - straight edges- surface plates – auto collimator.
- roughness measurement.

MACHINE TOOL ALIGNMENT TESTS: Principles of machine tool alignment testing on lathe, drilling, milling and planar machines.

Text Books:

1. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
3. Instrumentation, Measurement and Analysis B C Nakra, K K Chaudhry McGraw–Hill 4th Edition

Reference Books:

1. Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA,1990.
2. Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2006.
3. Engineering Metrology Gupta I.C Dhanpat Rai Publications.

4. Raghavendra, Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.
5. Donald Packman, “Industrial Instrumentation”, Wiley Eastern, 2004.

Web References:

1. Www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech III Year II Semester **Course Structure**

L	T	P	C
0	0	3	1.5

METROLOGY & ICS LAB

Internal Marks: 40

Course Code: P18MEL09 **External Marks: 60**

Course Prerequisite: Engineering physics.

Course Objectives:

To make use of suitable measuring instruments for the measurement of dimensions of the various components.

Note: The students have to conduct at least 7 experiments from each lab

Course outcomes:

Metrology Lab:

After completion of the lab the student will be able to

1. Measure the linear and angular dimensions of the components.
2. Measure the internal and external dimensions with suitable instruments.
3. Conduct the alignment and surface tests on the machine tools.
4. Test and calibrate the different temperature, pressure measurement instruments.
5. Measure and calibrate the rotameters and transducers.

List of Experiments:

METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Surface roughness measurement with roughness measuring instrument.

INSTRUMENTATION LAB

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and calibration of Mcleod gauge for low pressure.

B.Tech III Year II Semester **Course Structure**

L	T	P	C
0	0	3	1.5

HEAT TRANSFER LAB

Internal Marks: 40

Course Code: P18MEL10 **External Marks: 60**

Course Prerequisite: Thermodynamics

Course Objectives:

To apply the theoretical concept in practical, including application in heat transfer through solids, fluids in conduction, convection, radiation heat transfer.

Course outcomes:

After completion of the course the student will be able to

1. Perform steady state conduction experiments to determine the thermal conductivity of different materials.
2. Evaluate heat transfer coefficients for Forced convection over exterior surfaces, Natural Convection, Film wise and drop wise condensation and Compare with theoretical values.
3. Analyze the heat exchanger performance by using the method of logarithmic mean temperature difference and effectiveness.
4. Calculate radiation heat transfer of an emissivity of plate, Stefan Boltzmann's constant and Compare theoretical values.
5. Analyze the heat flux value by using boiling curve.

List of Experiments:

1. Determination of overall heat transfer co-efficient of a composite slab.
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere.
4. Determination of thermal conductivity of a metal rod.
5. Determination of heat transfer rate in drop and film wise condensation.
6. Determination of efficiency of a pin-fin.
7. Demonstration of heat pipe
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of heat transfer coefficient in forced convection.
10. Determination of heat transfer coefficient in natural convection
11. Determination of emissivity of a given surface.
12. Determination of Stefan Boltzman constant.
13. Determination of critical heat flux.
14. Study of two – phase flow.

B.Tech. III Year II Semester **Course Structure**

L	T	P	C
0	0	3	1.5

MATHEMATICAL MODELING LAB

Internal Marks: 40

Course Code: P18MEL11 **External Marks: 60**

Course Prerequisite: NIL

Course Objectives:

1. To apply the knowledge to solving mathematical problem and analyze the solutions.
2. To develop ability to use software tools needed to analyze mathematical problems.
3. To analyze problems in structural and thermal by using various software tools.
4. To demonstrate the different simulation tool for actuate various mechanism.
5. To describe the various problems for mode of frequency and Simple harmonic in 2D Component.

Course Outcome:

1. Apply the knowledge to solving mathematical problems in numerical solutions and analyze.
2. Analyze the various problems in structural and thermal by using various software tools.
3. Develop the ability to use software tools needed to analyze mathematical problems.
4. Demonstrate the different simulation tool for actuate various mechanism.
5. Describe the various problems for mode of frequency and Simple harmonic in 2D Component

List of Experiments:

(A) NUMERICAL COMPUTATION: (Minimum of SIX problems).**Note:** (Basics of MATLAB / C-Language/ MATLAB -Writing Program and finding solution by Numerical Methods including graphics for the following):

1. Bisection Method
2. Newton-Raphson Method
3. Secant Method
4. Gauss Elimination Method
5. Numerical differentiation and Integration
6. Initial-Value Problems (e.g. Runge-Kutta Method)
7. Boundary Value Problem (eg. Shooting Method)
8. Solution of 1-D and 2-D heat conduction with (Finite Difference method)

(B) ANALYSIS: (Minimum of SIX problem)

Note: (Perform FEM analysis using ANSYS / NASTRAN/FLUENT for the following given problem and compare the results with analytic methods).

1. Stress and deflection analysis in beams with different support conditions of Simple supported and cantilever beam.
2. Force and Stress analysis using link elements in Trusses, cables etc.
3. Analysis of axi- symmetric component.
4. Mode frequency analysis of a 2D Component.
5. Heat transfer analysis of steady state conduction.
6. Convective heat transfer.
7. Radiation heat transfer– Emissivity.
8. Simple harmonic analysis on a cantilever and simply supported beam.

(C) SIMULATION: (Minimum of THREE problem)

Note: (Perform Simulation using "C" language / MATLAB / DYNAMIC SOFTWARE / CREO Mechanism/ CATIA Simulation for the following given problem)

1. Simulation of air conditioning system with condenser and evaporator temperature as input to get COP.
2. Simulation of hydraulic /pneumatic cylinder.
3. Simulation of CAM and FOLLOWER mechanism.
4. Simulation Simple slider crank/ Four bar mechanism.

Text Books:

1. Applied Numerical Methods with MATLAB, S.C.Chapra, TMH
2. Numerical Methods for Engineers and Scientists, J.D.Hoffman, CRC Press
3. Numerical Methods, E Balagurusamy, TMH
5. MATLAB Programming for Engineers, Chapman, Thomson Learning
6. Getting Started with MATLAB, Rudra Pratap, Oxford University Press
7. Mastering MATLAB 7, Hanselman and Littlefield, Pearson Education.

B.Tech. IV Year I Semester

Course Structure

L	T	P	C
2	0	0	2

CAD / CAM

Internal Marks: 40

Course Code: P18MET16 **External Marks: 60**

Course Prerequisite: Nil

Course Objectives:

The general objectives of the course are to enable the students to

1. Provide the knowledge to student in functions of CAD/CAM design and applications.
2. Basic commands of Geometric Modelling and surface modelling.
3. Prepare the student in the area conventional numerical system, components, procedure and coordinates.
4. Learn importance, fundamentals of group technology and computer aided processplanning.
5. Know basic knowledge in the area of FMS and checking the quality of manufacturingmethods.

Course Outcomes:

At the end of the course the students shall be able to:

1. Demonstrate knowledge of computer, components of computer, storage devices, outputand input devices.
2. Design geometric, surface modelling CAD applications.
3. Write the CNC part programming.
4. Prepare in the area of GT concepts and CAPP concepts.
5. Apply the knowledge in the specific area of FMS and computer aide Quality control.

UNIT – I **(7 Lectures)**

Introduction, product cycle, basic structure, CPU, types of memory, input/output devices, design process, applications of CAD, benefits of CAD and benefits of CAM.

Hardware in Computer Aided Design: Introduction, design work station, graphicterminals and operator input devices, plotters and other output devices.

UNIT – II **(6 Lectures)**

Requirements of geometric modeling, models, construction methods. Introduction to surface modelling –types of surfaces, entities, basic commands, facilities of modeling and curve representations –Bezier curve and B-spline.

UNIT – III **(5 Lectures)**

CNC- Introduction-basic components, procedure, coordinate system, applications, advantages and disadvantages.

NC Part Programming: Introduction, types, G-Codes, M-codes, simple program on turning and drilling.

Computer Controls in NC: Introduction, problems with conventional NC, functions, advantages and DNC-components, functions, types and advantages.

UNIT-IV **(7 Lectures)**

Group Technology: Part families, parts classification & coding, machine cell design and benefits.

Computer Aided Process Planning: Introduction, types and benefits.

Production Planning and Control: Introduction, Traditional Production planning and control, cost planning and control.

UNIT – V **(5 Lectures)**

FMS: FMS — FMS Components — FMS Application & Benefits — FMS Planning and Control — Quantitative analysis in FMS.

Computer Aided Quality Control: Introduction, contact inspection method and noncontact inspection methods-Optical and non optical, Computer Aided Testing

Text Books:

1. Mikell. P. Groover, Emory W. Zimmer" A Text book of CAM/CAM" Pearson publication, 2nd edition 2001.
2. Chennakesava R. Alavala "A text book of CAD/CAM" PHI Publications, 2nd print 2008.

Reference Books:

1. P.N RAO "CAD/CAM: Principles and Applications" TMH Publications, 2nd edition 2007.
2. Ibrahim Zeid "CAD/CAM Theory and Practice" TMH Publications, 2nd edition 1995.
3. Radha Krishna & Subramanian "A text of CAD/CAM/CIM "New age Publications, 3rd edition 2008.

Web References:

1. www. nptel.ac.in
2. www.reserachgate.com
3. www.easyengineering.net
4. www.4.ebook.com.

B.Tech. IV Year I Semester

Course Structure

L	T	P	C
2	1	0	3

FINITE ELEMENT METHODS

Internal Marks: 40

Course Code: P18MET17 **External Marks: 60**

Course Prerequisite: Engineering Mechanics (P18EST04).

Course Objectives:

1. To provide the basic principles of finite element methods for the analysis procedures.
2. To classify the theory and characteristics of finite element methods that represent engineering structures.
3. To formulate and analyse the finite element methods to solve practical applications in beams and axisymmetric problems.
4. To derive and apply the finite element solutions to solve practical applications in structural member of trusses.
5. To develop the knowledge & skills needed to solve 1-D, 2-D, Isoperimetric elements and dynamic analysis of elements.

Course Outcomes:

Upon successful completion of this course the student will be able to:

1. Apply the concepts behind variational methods and weighted residual methods in FEM.
2. Identify the application and characteristics of FEA elements for engineering structures.
3. Solve the problems on beams and axisymmetric models by using finite element methods.
4. Analyse and implement various finite element methods to solve problems on trusses.
5. Implement the formulation techniques to solve 1-D, 2-D, isoperimetric elements & dynamic analysis of elements.

UNIT – I **(9 Lectures)**

FUNDAMENTALS OF FEM: Introduction - Stress and equilibrium, Strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, Simple problems & derivations.

UNIT – II **(10 Lectures)**

FINITE ELEMENT DISCRETIZATION: Discretization - domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III **(12 Lectures)**

ANALYSIS OF BEAMS: Introduction – types, supporting reactions, Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated load and UDL, simple problems on beams. Finite element modelling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

ANALYSIS OF TRUSSES: Introduction – types, Finite element modelling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress-strain and support reaction calculations.

UNIT-IV: **(8 Lectures)**

HIGHER ORDER & ISO PARAMETRIC ELEMENTS: One dimensional quadratic and cubic elements in natural coordinates. two dimensional four noded isoparametric elements and numerical integration.

UNIT – V **(6 Lectures)**

DYNAMIC & HEAT TRANSFER ANALYSIS - Formulation of finite element model, Simple formulation for heat transfer Problem. Element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors. Free vibration analysis.

Text Books:

1. SS Rao , "The Finite Element Methods in Engineering", Pergamon,2017.
2. YM Desai, Eldho & Shah, "Finite Element Method with applications in Engineering", Pearson publishers, 2011.
3. JN Reddy "An introduction to Finite Element Method", McGraw Hill, 1993.

Reference Books:

1. Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smithand Ted G. Byrom,"Finite Element Method for Engineers", John Wiley & sons (ASIA) Pvt Ltd, 2001.
2. Saeed Moaveniu, "Finite Element Analysis: Theory and Application with Ansys" Pearson Education, 2011.
3. G. Lakshmi Narasaiah, "Finite Element Analysis: for students & Practicing Engineers" BSP Books Pvt. Ltd, 2007.

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1. www.simscale.com
2. www.nptel.com
3. www.onlinelibrary.wailey.com
4. www.feaacademy.com
5. www.mathworks.com

B.Tech. IV Year I Semester

Course Structure

L	T	P	C
3	0	0	3

NON DESTRUCTIVE TESTING & EVALUATION
(Professional Elective – III)

Internal Marks: 40

Course Code: P18MET18 **External Marks: 60**

Course Prerequisite: Engineering Physics (P18BST04), Engineering Chemistry (P18BST06)

Course Objectives:

1. To provide fundamental knowledge to students on application, working principle and testing method of NDT.
2. To study the testing procedure, principles and applications on the radiographic test.
3. To emphasize the basic concepts of ultrasonic testing procedures, interpretation and calibrations.
4. To inculcate the students in the area of liquid penetrant and eddy current testing procedures.
5. To promote the technical knowledge to students in the area of magnetic and pressure testing.

Course Outcomes:

Upon successful completion of this course the student will be able to

1. Demonstrate the knowledge in the field of fundamental knowledge of NDT applications.
2. Apply the knowledge of radiographic testing procedure and applications.
3. Demonstrate the knowledge and testing procedures of ultrasonic test.
4. Perform inspections using liquid penetrant and eddy current testing.
5. Evaluate and interpret the results obtained from the magnetic and pressure testing.

UNIT – I **(9 Lectures)**

INTRODUCTION: Fundamentals and introduction to destructive and non-destructive testing-scope & limitations of NDT, testing methods for the detections of manufacturing defects of materials, various physical characteristics of materials and their applications, visual inspection-unaided and aided.

UNIT – II **(9 Lectures)**

RADIOGRAPHIC TESTING: Requirements, testing procedure, types of radiography testing-X ray radiography - principle, method of generation, industrial radiography techniques, inspection procedure, applications and limitations, advanced radiographic test- Xero and digital radiography. Safety procedures of industrial radiography.

UNIT – III **(9 Lectures)**

ULTRASONIC TEST: Basic principles of sound propagation, types of sound waves, Principle of ultrasonic test, methods of ultrasonic test, advantages and limitations, Piezoelectric Materials and it's effect on ultrasonic transducers, Inspection methods-pulse echo and phased array techniques, interpretations and calibrations.

UNIT-IV **(9 Lectures)**

ULTRASONIC TEST: LIQUID PENETRANT AND EDDY CURRENT TESTING:

Working principle, testing procedure, characterization of penetrants-types of penetrants, penetrant testing material, Fluorescence penetrant testing method-sensitivity, applications, advantages and limitations.

UNIT – V **(9 Lectures)**

MAGNETIC AND PRESSURE TESTING: Important terminologies related to properties of material-basic principles, ferrous and non-ferrous materials, magnetizing technique, testing procedure, equipments, fluorescent magnetic particle testing method, applications, advantages and limitations, pressure leak test and methods of pressure leak testing, applications and limitations.

Text Books:

1. Non Destructive test and evaluation of materials by J Prasad, GCK Nair/TMH Publishers, 2011.
2. Ultrasonic testing of materials by Josef, Krautkramer /Springer, 4th ed. 1990.
3. Non Destructive testing. Warren J. Mc Gonnagle, Verlag Gordon and Breach. New York, London, Paris. 2. Auflage 1971.

Reference Books:

1. Ultrasonic inspection training of material at level-2, issued by the international atomic energy agency, vienna, 1988.
2. "Non-Destructive Testing", W.T. Mc Gonnagle, McGraw Hill Book Co., , USA, 2013.
3. Non Destructive Testing", ELBS/Macmillan, Hampshire, Barry Hull and Vernon John, UK, 2015.
4. "Non-Destructive Evaluation and Quality Control", ASM Metals Handbook, V-17, , American Society of Metals, Metals Park, Ohio, USA, 2001.
5. Non Destructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1st edition, 1993.
6. Practical Non-Destructive Testing by Baldev Raj, T. Jayakumar, M. Thavasimuthu, Narosa Publishing, London, 2012.
7. Introduction to Non Destructive Testing, A Training Guide, Wiley- Inter science, New Jersey, USA, June 2005

Web References:

1. www.nptel.ac.in
2. www.ndt.net
3. www.asnt.org
4. www.inspectioneering.com

B.Tech. IV Year I Semester

Course Structure

L	T	P	C
3	0	0	3

REFRIGERATION & AIR CONDITIONING
(Professional Elective – III)

Internal Marks: 40

Course Code: P18MEE10 **External Marks: 60**

Course Prerequisite: Thermodynamics (P18MET01)

Note: Usage of data books is permitted

Course Objectives:

1. To introduce the students with a simplistic approach to the fundamental concepts of air refrigeration cycles.
2. To create an interest and intuitive understanding of the nuances of this core subject which deals with vapour compression refrigeration system and refrigeration components.
3. To create an interest and intuitive understanding of the nuances of this core subject which deals with vapour absorption and non-conventional refrigeration system.
4. To impart knowledge in air-conditioning processes, air conditioning systems and can evaluate cooling loads for air conditioning systems.
5. To impart knowledge on various air-conditioning equipment and clean room air conditioning.

Course Outcomes:

At the end of the course, the student will be able to

1. Explain air refrigeration cycle and different aircraft refrigeration systems
2. Explain refrigeration components and working of vapor compression refrigeration system
3. Describe vapor absorption, steam jet and nonconventional refrigeration systems
4. Explain psychrometric processes, different air conditioning systems and determine cooling and heating loads for air conditioning systems
5. Describe working of various air-conditioning equipment and clean room air conditioning.

UNIT – I **(10 Lectures)**

AIR REFRIGERATION SYSTEMS: Necessity and applications of refrigeration– unit of refrigeration and Coefficient of Performance (COP)–methods of refrigeration. Bell- Coleman cycle–open and closed air refrigeration systems, actual air refrigeration system. Necessity of cooling in aircraft, Types of aircraft refrigeration systems– simple bootstrap, regenerative and reduced ambient systems, Simple problems.

UNIT – II **(9 Lectures)**

REFRIGERANTS AND REFRIGERATION COMPONENTS: Refrigerants– desirable properties, types, nomenclature and selection, modern refrigerants Compressors–general classification and principles, condensers and cooling towers– classification and working principles, evaporators–classification and working principles, expansion devices–types and working principles.

VAPOR COMPRESSION REFRIGERATION SYSTEMS: Working principle and essential components of the system, simple vapor compression refrigeration cycle–COP, representation of cycle on T-s and P-h charts, effect of subcooling and superheating, cycle analysis, methods to improve the COP, use of P-h charts, Simple problems.

UNIT – III **(8 Lectures)**

VAPOR ABSORPTION REFRIGERATION SYSTEM: Calculation of maximum COP, description and working of ammonia–water refrigeration system, lithium bromide- water refrigeration system - two shell and four shell, and Domestic Electrolux refrigerator.

NON-CONVENTIONAL REFRIGERATION SYSTEMS: Steam jet refrigeration system-working principle, basic components, advantages and disadvantages (no mathematical treatment), Thermo electric refrigerator, Vortex tube.

UNIT-IV **(10 Lectures)**

AIR CONDITIONING SYSTEMS: Psychrometric processes, Summer and winter air conditioning systems, need for ventilation, consideration of infiltration, requirements of human comfort and concept of effective temperature, comfort chart, comfort airconditioning, requirements of industrial air conditioning.

DESIGN OF AIR CONDITIONING SYSTEMS: Bypass Factor (BF) – concept of SHF, ESHF and ADP - load concepts of RSHF, GSHF - Cooling load calculations and simple problems based on Psychrometric charts.

UNIT – V: **(8 Lectures)**

EQUIPMENT FOR AIR CONDITIONING SYSTEMS: Classification, heaters, humidifiers and dehumidifiers, filters, grills, registers, fans and blowers.

CLEAN ROOM AIR CONDITIONING: Clean Room – Definition and classification, sources of contamination, key elements of clean room design, difference between cleanroom A/C to conventional A/C, Filtration.

Text Books:

1. Refrigeration and Air-conditioning, Arora C.P., Tata Mc Graw –Hill, New Delhi, 2017
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai, 2018.
3. Handbook of ASHRAE, Robert Persons, 2019.

Reference Books:

1. Refrigeration and Air Conditioning, Manohar Prasad, New Age International, 2009.
2. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH, 2013
3. Principle of Refrigeration, Dossat R.D., 4th ed., Prentice-Hall, 2001
4. Principles of Refrigeration, Roy J. Dossat, Wiley Limited, 2002
5. Refrigeration and Air-conditioning, Stoecker W.F., and Jones J.W., Mc Graw – Hill, New Delhi, 1983

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2. www.dl.kashti.ir
3. https://easyengineering.net
4. https://www.sciencedirect.com
5. https://lecturenotes.in
6. http://home.iitk.ac.in
7. https://www.smartzworld.com

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

MECHANICAL VIBRATIONS
(Professional Elective – III)

Internal Marks: 40

Course Code: P18MEE11 **External Marks: 60**

Course Prerequisite: Nil

Course Objectives:

1. To learn the various types of vibrations, SHM.
2. To study the undamped and damped free vibrations systems used in simple systems.
3. To learn the basics of forced vibrations and determine the modes in two degrees systems.
4. To study various numerical methods for solving multi degrees of freedom systems
5. To learn the different measuring instruments for velocity and acceleration.

Course Outcomes:

After completion of the course the student will be able to

1. Apply the basic principle of vibrations in simple problems.
2. Analyze the undamped free vibrations and damped free vibrations systems.
3. Evaluate the frequencies for forced vibrations and systems with the two degrees of freedom.
4. Distinguish the different mathematical methods for solving multi degrees of freedom.
5. Apply the principles of measurement in various conditions.

UNIT – I **(8 Lectures)**

INTRODUCTION: Introduction to vibrations, terms of vibrations natural frequency, amplitude, damping ratio, damping coefficient, types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

UNIT – II **(10 Lectures)**

UNDAMPED FREE VIBRATIONS: Single degree of freedom-derivations for spring mass systems, methods of analysis, natural frequencies of simple systems, springs in series and parallel, torsional and transverse vibrations, effect of spring mass and problems.

DAMPED FREE VIBRATIONS: Single degree of freedom-Types of damping, analysis with viscous damping - derivations for over, critical and under damped systems, logarithmic decrement and Problems.

UNIT – III: (11 Lectures)

FORCED VIBRATIONS: Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems, multi degrees of freedom.

UNIT-IV (8 Lectures)

NUMERICAL METHODS FOR MULTI DEGREE FREEDOM OF SYSTEMS:

Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

UNIT – V (8 Lectures)

VIBRATION MEASURING INSTRUMENTS: Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

Text Books:

1. Elements of Vibration Analysis by Meirovitch, Tata McGraw-hill, 2014.
2. Mechanical Vibrations by G.K. Groover, Nemchand 8th Edition, 2018.

Reference Books:

1. Vibrations by W.T. Thomson, Pearson, 2008.
2. Mechanical Vibrations – Schaum series, Tata Mc Graw Hill Publication, 2017.
3. Vibration problems in Engineering by S.P. Timoshenko, Wiley Publications, 2007.
4. Mechanical Vibrations – V.Ram Murthy, Narosa Publications, 1989.

Web References:

1. https://byjus.com
2. https://www.brown.edu
3. https://getmyuni.azureedge.net.
4. https://scholarsmine.mst.edu
5. http://www.unife.it.

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

RENEWABLE SOURCES OF ENERGY
(Professional Elective – III)

Internal Marks: 40

Course Code: P18MEE12 **External Marks: 60**

Course Prerequisites: Engineering Physics (P18BST04), Engineering Chemistry (P18BST06)

Course Objectives:

1. Create awareness about sources of energy and able to estimate how long the available conventional fuel reserves will last.
2. Learn the fundamental concepts about solar energy systems and devices.
3. Design wind turbine blades and know about applications of wind energy for water pumping and electricity generation.
4. Assimilate the working of OTEC system and different possible ways of extracting energy from ocean
5. Learn the fundamental concepts about Magneto-hydrodynamics and fuel cells.

Course Outcomes:

After completion of the course the student will be able to

1. Assimilate of renewable and non-renewable sources of energy
2. Gain knowledge about working principle of various solar energy systems
3. Understand the application of wind energy and wind energy and Bio-mass conversion system.
4. Develop capability to do basic design of Ocean Thermal Energy Conversion
5. Assimilate the applications of different renewable energy sources like hydro, fuel cells etc.

UNIT – I **(9 Lectures)**

ENERGY RESOURCES; Introduction to Conventional Energy Resources - Availability and their limitations; Energy Non-Conventional Energy Resources – Classification, Advantages, Limitations, Comparison of Conventional and Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario. Energy Storage: Sizing and Necessity of Energy Storage.

UNIT – II **(9 Lectures)**

SOLAR THERMAL SYSTEMS: Introduction, Solar Constant, Basic Sun-Earth Angles, Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer, Principle of Conversion of Solar Radiation into Heat, – Solar thermal collectors and characteristics –

Flat plate collectors – Heat transfer processes – Solar concentrators parabolic trough, parabolic dish, Central Tower Collector –performance and evaluation

UNIT – III **(9 Lectures)**

WIND ENERGY: Introduction, Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS ENERGY: Introduction, Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT-IV **(9 Lectures)**

GEOTHERMAL ENERGY & OCEAN THERMAL ENERGY CONVERSION (OTEC): Introduction, Resources, types of wells, methods of harnessing the energy, potential in India. Introduction, Resources, Ocean thermal energy conversion (OTEC) Availability, theory and working principle, performance and limitations.

UNIT – V **(9 Lectures)**

MAGNETO-HYDRO DYNAMICS (MHD): Introduction, Principle of working of MHD Power plant, performance and limitations.

FUEL CELLS: Principle of working of various types of fuel cells and their working,performance and limitations.

Text Books:

1. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. "Renewal Energy Resources", John Twideu and Tony Weir, BSP Publications, 2006.
3. "Energy Resources: Conventional & Non-Conventional", M.V.R. Koteswara Rao, BSP Publications, 2006.
4. Non-Conventional Energy Resources, Khan B.H., Tata McGraw Hill, New Delhi, 2006.
5. Renewable Energy Sources, Twidell, J.W. & Weir, A. EFN Spon Ltd., UK, 2006.
6. Solar Energy: Fundamentals and Applications, Garg, Prakash, Tata McGraw Hil, 1997.

Reference Books:

1. Non-Conventional Energy Sources, Khanna Publications, G.D. Rai, New Delhi, 2011.
2. "Renewable Energy, Power for a Sustainable Future", Godfrey Boyle, , Oxford University Press, U.K., 1996.
3. Biogas Technology – A Practical Handbook, Khandelwal, K.C., Mahdi, S.S., Tata McGraw-Hill, 1986.
4. "Fundamentals Design, Modeling & Applications", Tiwari. G.N., Solar Energy – Narosa Publishing House, New Delhi, 2002.

5. “Wind Energy Conversion Systems”, Freris. L.L., Prentice Hall, UK, 1990.

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1. https://www.sciencedirect.com
2. https://new.ingwb.com
3. https://www.nrel.gov
4. https://biomassenergytechniques.com
5. https://www.eia.gov
6. https://www.energy.gov

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

DESIGN OF HYDRAULICS AND PNEUMATICS

Internal Marks: 40

Course Code: P18MET18 **External Marks: 60**

Course Prerequisite: Fluid Mechanics and Hydraulic Machines (P18MET03)

Course Objectives:

1. To provide student with knowledge on the application of fluid power, pneumatic system and construction.
2. To study the fundamental principles, design and operation of hydraulic actuators and control values.
3. To provide students with an understanding of the hydraulic circuit design considerations and components utilized in modern industrial fluid power system.
4. To develop a measurable degree of competence in the design, construction and operation of pneumatic circuits.
5. To emphasize basic theory, components, construction and function of the elecro-pneumatics.

Course Outcomes:

Upon completion of this course, the students will be able to:

1. Identify hydraulic and pneumatic components, its symbol and usage.
2. Design hydraulic circuits and control devices.
3. Identify and analyze the functional requirements of a hydraulic circuits system for a given application.
4. Visualize how to pneumatic circuit will work to accomplish the function.
5. Design and understand electro-pneumatic circuit and their application in recent automation revolution.

UNIT– I **(9 Lectures)**

FUNDAMENTAL PRINCIPLES Introduction to Fluid power systems – Advantages and Applications, Industrial prime movers- Electrical system, hydraulic system and pneumatic system. Pumping Theory, Pump Classification – Construction and Working, ISO/ANSI Symbols used in hydraulic and pneumatic systems. Selection of Hydraulic and pneumatic system.

UNIT II **(9 Lectures)**

FLUID POWER ACTUATORS AND CONTROL DEVICES: Fluid Power Actuators-

Cylinders and Rotary Actuators-Types, construction and application. Design considerations –Cylinder speed, load carrying capacity for extending and retracting stroke

– Problems. Control devices - Types and operation of control valves, Check valves, pressure control valves Servo, Proportional valves and Solenoid valve.

UNIT – III **(9 Lectures)**

HYDRAULIC CIRCUITS AND DESIGN: Hydraulic circuit design considerations- Accumulators, Intensifiers, Industrial hydraulic circuits- Actuator synchronization, Speed control, Regenerative, Pump unloading circuit, double pump hydraulic system – counter balance and dynamic breaking. Hydrostatic transmission-Electro hydraulic circuits-Mechanical hydraulic servo systems.

UNIT – IV **(9 Lectures)**

PNEUMATIC CIRCUITS AND DEVICES: Design of basic pneumatic circuit – Conventional and Cascade method- Elements – Ladder diagram – DELAY, OR, AND and NOT functions – Design Problems.

PNEUMATIC ACTUATORS AND VALVES- FRL unit, DCV, FCV, PCV, time delay, quick exhaust, twin pressure, shuttle Valves.

UNIT –V **(9 Lectures)**

ELECTRO PNEUMATIC SYSTEM: Electrical signals, Signal flow in control system- components of electrical signal control, Sensors for displacement and pressure, proximity sensors capacitive, inductive, and optical, pressure sensor, Relays & contactors. Electrically actuated DCVs, Electrical circuit diagrams, symbols- Wiring electro pneumatic system. Programmable Logic Controllers (PLCs) - introduction, block diagram, PLC operations

Text Books:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.
2. Shanmuga sundaram .K, “Hydraulic and Pneumatic Controls”. Chand & Co, 2006
3. “Hydraulic and Pneumatic Design”, Festo Catalouge-2019

Reference Books:

1. “Oil Hydraulics Systems – Principles and Maintenance”, Majumdar, S.R., Tata McGRaw Hill, 2001.
2. “Pneumatic Systems – Principles and Maintenance”, Majumdar, S.R., Tata McGRaw Hill, 2007.
3. “Basic Fluid Power”, Dudley, A. Pease and John J Pippenger, Prentice Hall, 1987.
4. “Hydraulic and Pneumatic Controls”, Srinivasan.R, Vijay Nicole Imprints, 2008.
5. “Pneumatic Control”, Joshi.P, Wiley India, 2008.
6. “Pneumatics Concepts, Design and Applications”, Jagadeesha T, Universities Press, 2015.

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1. www. nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.myclgnotes.com
5. www.me-mechanicalengineering.com

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

ADDITIVE MANUFACTURING
(Professional Elective - IV)

Internal Marks: 40

Course Code: P18MEE13 **External Marks: 60**

Course Prerequisite: Production Technology (P18MET05)

Course Objectives:

1. To understand of the basic fundamentals of rapid prototyping.
2. To understand the different data preparation techniques and tool path generation.
3. To expose the students to different types of rapid prototyping processes, materials used in RP systems.
4. To understand the importance of rapid tooling in product development process.
5. To understand the different applications of rapid prototyping.

Course Outcomes:

After completion of the course the student will be able to

1. Identify the use of Rapid Prototyping Techniques in the manufacturing of complex components that is otherwise very difficult to manufacture.
2. Develop CAD models and data formats for 3D printing.
3. Apply the basic principles of different rapid prototyping systems for product development.
4. Apply the basic principles of rapid tooling (RT) technologies for product development
5. Realize the application of RP, RT, and RE technologies for product development.

UNIT-I **(8 Lectures)**

INTRODUCTION: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, RP wheel.

UNIT-II **(9 Lectures)**

CAD MODELLING, DATA PROCESSING AND SOFTWARE'S FOR RP: CAD model preparation, Data Requirements, different types of Data formats, Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation, RP software's
– Magic's, Mimics and 3d Doctor.

UNIT-III **(11 Lectures)**

RP SYSTEMS: Classification of RP - Photo-polymerization process, Powder Bed Fusion process, Applications of Powder Bed Fusion Processes. Extrusion based RP Systems, 3D Printing process modelling, Applications of Printing Processes.
Laminated Object Manufacturing (LOM), Beam Deposition: Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Processing - structure-properties, relationships, Benefits and drawbacks.

UNIT IV **(9 Lectures)**

RAPID TOOLING: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

UNIT-V: **(8 Lectures)**

RP APPLICATIONS AND CASE STUDIES: Design, Engineering Analysis and planning, medical, reverse Engineering, case studies related to mechanical and automotive industries.

Text Books:

1. "Rapid prototyping: Principles and applications", Chua C.K., Leong K.F., and Lim C.S., Third Edition, World Scientific Publishers, 2010.
2. "Rapid prototyping", Gebhardt A., Hanser Gardener Publications, 2003.
3. Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Pham, D.T., Demov, S.S., Springer-Verlag London Limited, (2001).
4. Rapid Prototyping: Principles and Applications, Noorani, R., John Wiley & Sons, Inc., New Jersey, (2006).
5. Mastering CAD/CAM, Zeid, I., Tata McCraw Hill, (2006).

Reference Books:

1. "Rapid Prototyping and Engineering applications: A tool box for prototype development", Liou L.W. and Liou F.W CRC Press, 2007.
2. "Rapid Prototyping: Theory and practice", Kamrani A.K. and Nasr E.A., Springer, 2006.
3. "Rapid Tooling: Technologies and Industrial Applications", Hilton P.D. and Jacobs P.F., CRC press, 2000.
4. "CAD and Protyping for Product Design", Dougles Bryden, Laurence King Publishing, 2014.
5. Rapid Prototyping - Laser-based and Other Technologies, Patri, K. V., Weiyin, Ma, Kluwer Academic Publishers, U.S.A., (2003).
6. Rapid Prototyping, Tooling and Manufacturing, Hague, R.J.M., Reeves, P.E., iSmithers Rapra Publishing, (2000).
7. Computer Aided Engineering Design, Saxena, A., Sahay, B., Anamaya Publishers, New Dehi, (2005).

8. Rapid Manufacturing- An Industrial Revolution for the Digital Age, Hopkinson, N., Hague, R.J.M., Dickens, P.M., John Wiley & Sons Ltd., U.K., (2006)

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2. https://ultimaker.com/software
3. https://www.materialise.com/en/software/magics
4. https://www.materialise.com/en/medical/mimics-innovation-suite/mimics
5. https://futureskillsprime.in
6. https://onlinecourses.nptel.ac.in/noc21_me115/preview
7. https://www.coursera.org/learn/3d-printing-software
8. https://www.coursera.org/learn/3d-printing-revolution
9. http://vlabs.iitb.ac.in/vlab/
10. https://www.ge.com/additive/

B.Tech. IV Year I Semester

Course Structure

L	T	P	C
3	0	0	3

NANO TECHNOLOGY
(Professional Elective – IV)

Internal Marks: 40

Course Code: P18MEE14 **External Marks: 60**

Course Prerequisite: Nil

Course Objectives:

1. To provide the fundamental knowledge to students in nano technology.
2. To prepare and learn the student in the area of synthesis of nano materials and technical approach.
3. To provide the concepts of various characterization of nano materials and either types.
4. To learn the basic technological concepts knowledge in carbon nano technology and applications.
5. To promote the students and apply the concepts in the application of nano technology in various fields.

Course Outcomes:

After completion of the course the student will be able to

1. Apply fundamental knowledge in the nanotechnology, basic structure and sizes.
2. Describe the synthesis concepts of nano particles and technical approach.
3. Apply the technology knowledge in the area of various domains for characterization of nano particles.
4. Apply appropriate techniques and application of carbon nano technology.
5. Demonstrate and apply technical knowledge in the field of application of nano materials.

UNIT – I **(9 Lectures)**

FUNDAMENTALS OF NANO TECHNOLOGY: Introduction-history of nano science- definition of nano meter, nano material and classifications. Crystal geometry-directions- planes. Nano structure-band, size, properties and effect of sizes. Electronic structure of nano materials.

UNIT – II **(9 Lectures)**

SYNTHESIS OF NANO MATERIALS: Synthesis-bulk polycrystalline samples, growth of single crystals, Techniques for preparation of nano particle – bottom up, top down approaches and either types. Requirements for semiconductor nano materials and nano structures, techniques for growth of nano structures.

UNIT – III **(10 Lectures)**

CHARECTERIZATION OF NANO PARTICLES: Techniques-X-Ray diffraction and scherrer method-scanning electron microscopy-transmission electron microscope, scanning probe microscopy, atomic force microscopy, piezo response microscopy, X-ray photoelectron spectroscopy, XANES and XAFS-angle resolved photoemission spectroscopy, diffuse reflectance spectra-photoluminescence spectra-Raman spectroscopy.

UNIT – IV **(8 Lectures)**

CARBON NANO TECHNOLOGY: Synthesis, nucleation, growth, morphology of diamond and applications of nano crystalline diamond films. Characterization-carbon allotropes, graphene and applications of carbon nano tubes.

UNIT – V **(9 Lectures)**

APPLICATIONS OF NANO TECHNOLOGY: Application in material science-biology, medicine, surface science, energy and environment. Applications of nano structured thin fins and quantum dots.

Text Books:

1. Nano science and Nanotechnology: Fundamentals of frontiers by M.S Ramachandra Rao, Shubra Singh, Wiley publishers, 2013.

Reference Books:

1. Introduction to Nanotechnology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers, 2003.
2. Nanotechnology: An Introduction by Jermy J Ramsden, Elsevier publishers, 2011.
3. Nano Materials by A. K. Bandyopadhyay, New Age International, 2008.
4. Nano: The Essentials by T.Pradeep, TMH publishers, 2007.
5. Nano Technology: The Science of Small by M.A Shah, K.A Shah, Wiley Publishers, 2013.
6. Principles of Nanotechnology by Phani Kumar, Scitech publications, 2010.

Web References:

1. www.nptel.ac.in
2. www.smartzworld.com
3. www.lecturenotes.in
4. www.understandingnano.com
5. www.nanowerk.com

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

POWER PLANT ENGINEERING
(Professional Elective – IV)

Internal Marks: 40

Course Code: P18MEE15 **External Marks: 60**

Course Prerequisite: Nil

Course Objectives:

1. To provide the fundamental knowledge in steam power plant & energy audit systems.
2. To familiarize the students to the working of gas power plant, combined cycles.
3. To emphasize the working principles, components of hydroelectric power plant.
4. To expose the knowledge of the basic principles of nuclear power plant.
5. To prepare the student economic, environmental impacts.

Course Outcomes:

After completion of the course the student will be able to

1. Demonstration the functions of steam power plant, components & energy audit procedure
2. Identify and analyze the working principle of the gas power plants.
3. Explain woerking of the hydroelectric power plant and it's working principle.
4. Demonstration of the working principle of the nuclear power plant.
5. Evaluation the economic considerations and environmental issues of the power plants.

UNIT-I **(9 Lectures)**

STEAM POWER PLANT -Introduction-requirements & components, Working principle, Plant Layout, Boiler, turbine, condenser and sub systems, Fuel and Ash handling systems.

ENERGY AUDIT: Need, types, methodology, barriers, analysis on energy costing and sharing, bench marking, fuel and energy substitution, billing parameters in APZENCO, instruments for energy audit

UNIT–II **(9 Lectures)**

DIESEL POWER PLANT: Introduction, Requirements, Working principle, Plant Layout, cycles - Otto cycle, diesel cycles, dual and Brayton cycles. Combined power plant.

GAS TURBINE PLANT: Introduction, Requirements, Working principle, Plant Layout & Sub systems.

UNIT–III **(9 Lectures)**

HYDRO ELECTRIC POWER PLANTS: Classification, Typical Layout and associated components including Turbines, Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT–IV **(9 Lectures)**

NUCLEAR POWER PLANTS: Introduction, requirements-working principle, Plant Layout, sub systems. Nuclear fuel – reactor operation, Pressurized water reactor, Boiling water reactor, uranium reactors, liquid metal cooled reactors and safety measures for the nuclear reactors.

UNIT–V **(9 Lectures)**

ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES - Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

Text Books:

1. Power Plant Engineering, P.K. Nag, McGrawHill Publications, 2002.
2. Power Plant Engineering, Hegde, Pearson Publications, 2014.

Reference Books:

1. Power Plant Engineering, Gupta, PHI, 2012.
2. Power Plant Engineering, AK Raja, New age, 2006.

Web References:

1. www.sandfoundary.com
2. www.Books.google.co.in
3. www.Easyengineering.net

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

TRIBOLOGY
(Professional Elective – IV)

Internal Marks: 40

Course Code: P18MEE16 **ExternalMarks: 60**

Course Prerequisites: Fluid Mechanics & Hydraulic Machinery (P18MET03), Design of Machine Members-II (P18MET15).

Course Objectives:

1. To learn about hydro static lubrications & applications of journal bearings.
2. To expose the student about different types of bearings, bearing materials,
3. To get the knowledge about friction characteristics and power losses in journalbearings.
4. To provide knowledge about theory and concepts about different types of lubrication.
5. To know about the types of materials used in the bearings.

Course Outcomes:

After completion of the course the student will be able to

1. Demonstration about the friction characteristics in journal bearings.
2. Knowledge about different theories of lubrication to reduce friction and wear.
3. Analysis of journal bearing design and its practical considerations
4. Understand Applications of hydro dynamic journal bearings.
5. Understand about the types are materials which are used in bearings.

UNIT–I **(10 Lectures)**

STUDY OF VARIOUS PARAMETERS: Viscosity, flow of fluids, viscosity and its variation, absolute and kinematic viscosity, temperature dependent variation, viscosity index, determination of viscosity, different viscometers used.

HYDROSTATIC LUBRICATION: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT–II **(10 Lectures)**

HYDRODYNAMIC THEORY OF LUBRICATION: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro-dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti -friction bearing.

UNIT–III **(10 Lectures)**

INTRODUCTION TO FRICTIONS IN THE BEARINGS: Friction and power losses in journal bearings, Calibration of friction loss, friction in concentric bearings, bearing modulus, Sommer-field number, heat balance, practical considerations of journal bearing design

UNIT–IV **(10 Lectures)**

AIR LUBRICATED BEARING: Advantages and disadvantages, application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect. Study of current concepts of boundary friction and dry friction.

UNIT-V **(5 Lectures)**

TYPES OF BEARING OIL PADS: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings, externally pressurized bearings, Magneto Rheological bearings, bearing materials: General requirements of bearing materials, typesof bearing materials.

Text Books:

1. Engineering Tribology, Gwidon W. Stachowiak & Andrew W. Batchelor, Elesevier,1993.
2. Engineering Tribology, Prasanta Sahoo, PHI Publication, 2005.

Reference Books:

1. Tribology, B.C. Majumdar, S. Chand, 2008.
2. Fundamentals of Tribology, Basu, Sen Gupta and Ahuja, PHI, 1st Edition 2010.
3. Tribology in Industry, Sushil Kumar Srivatsava, S. Chand & Co.2008.

Web References:

1. www.tribiologyindia.org
2. www.professional.mit.edu
3. www.onlinelibrary.wiley.com

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
3	0	0	3

MECHATRONICS

Internal Marks: 40

Course Code: P18MET19 **External Marks: 60Course**

Pre-requisite: Nil

Course Objectives:

1. To provide the knowledge to students in mechatronics system and microprocessorprocessor.
2. To inculcate the microprocessor functions and applications of electronic devices.
3. To prepare the students to able to write PLC and functions
4. To know about the working principles of Sensors and applications
5. To learn about the mechatronics system and actuators Transducers.

Course Outcomes:

After completion of the course the student will be able to

1. Describe the fundamentals of mechatronics system.
2. Demonstrate the functions of Microprocessor, microcontroller and application
3. Apply the knowledge in PLC for industrial automation.
4. Acquire knowledge in functions of Sensors and application.
5. Apply the concepts in several of mechatronics system interfacing and actuator.

UNIT-I **(9 Lectures)**

FUNDAMENTALS: Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Microprocessor Architecture-open and closed loop control strategies solid state devices. Electronic control input devices. Types of indicating Instruments - millimeters –Oscilloscopes– instrument transformers (CT and PT).

UNIT-II **(9 Lectures)**

MICROPROCESSOR AND MICRO CONTROLLER: Introduction –Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram- Mechanical applications, Architecture of 8255, Control Stepper Motor Control, Traffic Control interface-Temperature Control.

UNIT-III **(9 Lectures)**

PROGRAMMABLE LOGIC CONTROLLER: Introduction, Basic structure, Input and output processing, Programming, Mnemonics – Timers, counters and internal relays, Data handling, Selection of PLC, PLCs versus computers, application of PLCs for control. Keyboard interfacing, LED display, interfacing, ADC and DAC interface.

UNIT-IV **(9 Lectures)**

SENSORS: Introduction to transducers - Classification of Transducers, Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall Effect and Mechanical. Magnetic Sensors-Photo conductive cell, photo voltaic, Photo resistive, LDR

– Fiber optic sensors -Incremental and encoders. LVDT, Strain gauges. Force/Torque – Load cells. Temperature – Thermocouple, Bimetallic Strips, Thermistor and RTD.

UNIT-V **(9 Lectures)**

ACTUATORS AND MECHATRONIC SYSTEM: Introduction to Actuators - Solenoids, thyristors, , BJT, FET, DC motor, Servo motor, BLDC Motor, AC Motor, stepper motors. Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier

Text Books:

1. Mechatronics Integrated Mechanical Electronics Systems, KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram, WILEY India Edition, 2008.

Reference Books:

1. Mechatronics, Smaili A, Mrad F, Oxford Higher Education, Oxford University Press,2007.
2. Mechatronics Source Book, Newton C Braga, Thomson Publications, 2003.
3. Mechatronics, N. Shanmugam, Anuradha Agencies Publishers, 2010.
4. Mechatronics System Design, Devdas Shetty, Richard, Thomson, 2020.
5. Mechatronics, M.D.Singh, J.G.Joshi, PHI, 2006.
6. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, W. Bolton, Pearson, 2012.
7. Mechatronics: Principles and Application, Godfrey C. Onwubolu, Elsevier, Indian print, 2005.

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2. https://www.cgaspirants.com
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B.Tech. IV Year I Semester

Course Structure

L	T	P	C
0	0	3	1.5

SIMULATION LAB

Internal Marks: 40

Course Code: P18MEL12 **External Marks: 60**

Course Prerequisite: Engineering Graphics (P18EST02), CAD/CAM (P18MET16).

Course Objectives:

1. To prepare the students able to drafting for various engineering components by usingCAD tools.
2. To provide the knowledge to students able to design 3D modeling, part modeling, surface modeling for simple components.
3. To inculcate student in area of design analysis the heat transfer problems by using ANSYS-FLUENT tool.
4. To apply in the knowledge of CNC and NC basic commands, part programming and simulation.

Course Outcomes:

After completion of the course the student will be able to:

1. Demonstrate knowledge in drafting for various engineering components by usingcomputer aided tools.
2. Acquire knowledge on utilizing 3D modeling, part modeling surface modeling forsimple components.
3. Analyze the heat transfer problems, conduction, convection and radiation by using CAEtools.
4. Apply technical knowledge in NC and CNC part programming and simulation by usingCAM tools.

PART-A

1. **DRAFTING:** Development of part drawings for various components - orthographic and isometric representation, dimensioning and tolerances. Scanning – plotting. studyof script, DXE and IGES files.

2. **PART MODELING:** Generation of various 3D modeling commands - protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation- Boolean, Surface modeling and assembly, ISO and template-design simple components.

PART-B

3. Using ANSYS-FLUENT tool to analyze heat transfer problems
   a) Steady state conduction problem
   b) Lumped heat transfer problem.
   c) Convective heat transfer problems– Internal flow of fluids - velocity and thermal boundary layers conditions.
   d) Convective heat transfer problems – External flow of fluids - velocity and thermal boundary layers conditions.
   e) Radiation heat transfer problems – Emissivity- black and gray body.

PART-C

4. NC and CNC programming by using CAM tools:
   a) Study of NC Machines -various post processors.
   b) NC and CNC programming – CNC lathe for simple turning and step turning by using FANUC controller.
   c) Simulation of CNC programming for milling –facing, hole, pocketing using FANUC Controller.
   d) CNC Tool path generation - G-Code generation using Pro/E/Master CAM.

Packages to be provided to cater to drafting, modeling & analysis from the following: CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

MECHATRONICS LAB

Internal Marks: 40
Course Code: P18MEL13 **External Marks: 60**

Course Outcomes:

At the end of the course, the student will be able to:

1. Measure the characteristics of LVDT, Strain Gauge, Summing Amplifier & OptoTransducer
2. Develop PLC programs for Timers & Counters.
3. Simulate and analyse PID controllers for a physical system using MATLAB.
4. Develop pneumatic and hydraulic circuits using Automaton studio.

List of Experiments

1. **DYNA 1750 Transducers Kit** :-
   a) Study and performance of various Sensors - RTD, LVDT, Load cell Strain Gauge andphoto voltaic
   b) Study of rectifiers and filters
   c) Study of logic gates, adder and flip-flops

2. **PLC PROGRAMMING**
   a) Study of microcontroller programming and interfacing – Logic gateson Timers & counters.
   b) Study of actuators and Interfacing

3. **AUTOMATION STUDIO SOFTWARE**
   a) Introduction to Automation studio & its control.
   b) Draw & Simulate the Hydraulic circuit for meter-in and meter-outfor signal – Double acting cylinders connection.

4. **MATLAB PROGRAMMING**
   a) Sample programs on MATLAB.
   b) Simulation and analysis of PID controller using SIMULINK.

B.Tech. IV Year I Semester **Course Structure**

L	T	P	C
0	0	3	1.5

EMPLOYABILITY SKILLS

Internal Marks: 40

Course Code: P19MCT07 **External Marks: 60**

Course Objectives:

The main aim of this course is

1. To learn how to make effective teams, personality development and leadership skills.
2. To learn skills for discussing and resolving problems on the work site
3. To assess and improve personal grooming
4. To promote safety awareness including rules and procedures on the work site
5. To develop and practice self management skills for the work site

Course Outcomes:

By the end of this course, the student

1. Recite the corporate etiquette.
2. Make presentations effectively with appropriate body language
3. Be composed with positive attitude
4. Apply their core competencies to succeed in professional and personal life

A list of vital employability skills from the standpoint of engineering students with discussion how to potentially develop such skills through campus life.

UNIT-1

Career Mapping: Inculcate workplace and professional etiquettes.

Tips for Success.

Etiquette and Manners – Social and Business

Time Management – Concept, Essentials, Tips.

UNIT-2

Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.

Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills, Case studies and discussions etc.

UNIT-3

Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution.

Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress

UNIT-4

Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.

Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertiveness Skills.

UNIT-5

Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

References Books:

1) Wallace, Personality Development, India Edition, CENGAGE Learning, 2008.

2) P.Subba Rao ,Personnel and Human Resource Management , Himalaya Publishing House; Fifth Edition,2015

3) Ramachandran and Karthik, From campus to Corporate, India, PEARSON Publication, 2016.

4) Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.

5) S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

6) Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

Related Activities:

- Comparing company Work culture, Nature and Management styles - company information.
- Handling personnel matters – eg Time management, Communication at work.
- Role plays of chairing business meetings and negotiations.
- Conflicts resolution Games
- Team building and leadership skills Case studies and discussions
- Find out the leadership styles of various companies CEO’s.
- Tips for Enhancing Your Own Emotional Intelligence or Team

B.Tech. IV Year II Semester **Course Structure**

L	T	P	C
3	0	0	3

ADVANCED AUTOMOBILE TECHNOLOGY

Internal Marks: 40

Course Code: P18MET20 **External Marks: 60**

Course Prerequisite: Basic Electrical & Electronics Engineering (P18EST01), Thermal Engineering – I (P18MET06) and Thermal Engineering-II (P18MET12).

Course Objectives:

1. To provide the Fundamental Knowledge in Automobile Components.
2. To inculcate students in the area of functions of Steering and Breaking Systems.
3. To provide broad knowledge about the Working Concepts and Components of Electrical and Hybrid Vehicle.
4. To prepare the students for need and working principle of electrical and hybrid vehicledrives.
5. To learn about the Functions of Battery, Testing and Charging Methods.

Course Outcomes:

After completion of the course the student will be able to

1. Understand fundamental Concepts of automobiles body, chassis and transmissionsystems.
2. Demonstrate the Working Principle and Functions of various Steering and BreakingSystems.
3. Demonstrate the Working Principle and Components of Electrical and Hybrid Vehicle.
4. Apply the Knowledge in Electrical and Hybrid Vehicle Drives.
5. Examine the Student Knowledge in Battery Charging and Testing in ElectricalVehicles.

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UNIT-I (9 Lectures)

INTRODUCTION: Main Components of four wheeler automobile Construction Details, Basic construction of chassis–Types. Power transmission –Types of Front Axles and Stub Axles. Differential unit- Differential principle, Constructional details. Suspension System-Active and Passive. Clutches-Working principle and their types.

UNIT-II: (9 Lectures)

STEERING SYSTEM: Steering geometry, Camber and Castor Angle, king pin, toe In, Toe-Out, Power Steering, Hydraulic Power, Electro-Hydraulic Power, Electric Power Steering.

BREAKING SYSTEM: Working Principle, Construction Detail, Types of Breaking System, Advanced Breaking System-, ABS, Regenerative, Electromagnetic, Electronic Breaking System of EV and HEV.

UNIT-III **(9 Lectures)**

ALTERNATIVE SYSTEM: Need for hybrid and electric vehicles, main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.

UNIT – IV **(9 Lectures)**

HYBRID ELECTRIC DRIVE TRAINS: Basic concept of hybrid traction, various hybrid drive, Train topologies, Power flow control in hybrid drive train topologies.

ELECTRIC DRIVE TRAINS: Basic concept of electric traction, various electric drive-Train topologies, Power flow control in electric drive train topologies.

UNIT – V **(9 Lectures)**

ENERGY STORAGE: Introduction to Energy Storage- Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Battery Testing- Open and Close Test, HRD Test and Cell Test. Battery Maintenance -Method of Charging

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Sing, Standard Publishers, 2011
2. Automobile Engineering, William Crouse, McGraw Hill Distributors, 1976
3. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley, 2003.
4. Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, CRC Press, 2004

Reference Books:

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications, 2017
2. Automotive Mechanics, Heitner, 2004.
3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

Web References:

1. https://www.nptel.ac.in
2. https:indiabix.com
3. https://www.saeindia.org
4. https://blog.oureducation.in

B.Tech. IV Year II Semester **Course Structure**

L	T	P	C
2	0	0	2

INTELLECTUAL PROPERTY RIGHTS AND PATENTS

Internal Marks: 40

Course Code: **External Marks: 60**

Course Prerequisites: Nil

COURSE OBJECTIVES:

1. This course is aimed at familiarizing researchers with the nuances of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their research activities.
2. IPR internalization process to help the researchers to set targeted objectives in their research project and also to design and implement their research.
3. To give the Students "hands- on –training" in literature, including patent search and documentation of research activities that would aid an IPR expert to draft apply and prosecute IPR applications.
4. To make the students familiar with basics of IPR and their implications in Research, development and commercialization.
5. Facilitate the students to explore career options in IPR.

LEARNING OUTCOMES:

1. Have an understanding of the fundamental legal principles relating to confidential information, copyright, patents, designs, trademarks and unfair competition;
2. be able to identify, apply and assess principles of law relating to each of these areas of intellectual property;
3. understand the legal and practical steps needed to ensure that intellectual property rights remain valid and enforceable;
4. be able to demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing;
5. understand current and emerging issues relating to the intellectual property protection, including those relating to indigenous knowledge or culture, information technology especially the distribution of material on the internet, biotechnology and international trade

Unit I:

Introduction to Intellectual Property Law – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights.

Unit II :

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law Semiconductor Chip Protection Act.

Unit III:

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

Unit IV:

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

Unit V:

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi.
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press).
3. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi.
4. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
5. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
6. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right”

TEXT BOOKS:

1. Intellectual Property Rights and the Law, Dr. G.B. Reddy, Gogia Law Agency.
2. Law relating to Intellectual Property, Dr. B.L.Wadehra, Universal Law Publishing Co.
3. Law of Intellectual Property, Dr.S.R. Myneni, Asian Law House

B.Tech. IV Year II Semester **Course Structure**

L	T	P	C
0	0	0	0

ENTREPRENEURSHIP DEVELOPMENT

Internal Marks: 40

Course Code: **External Marks: 60**

Course Prerequisites: Nil

COURSE OBJECTIVES

1. The objective is to expose the students to the concepts of entrepreneurship and role of entrepreneurship in economic development.
2. Further the student will be given enough exposure to idea generation and business model development.
3. Introducing National and state level Institution and agencies who are working for developing entrepreneurship in the country to increase the overall productivity.

COURSE OUTCOMES:

1. Understand the importance of entrepreneur in economic development
2. Apply idea generation techniques
3. Analyse , empathise and develop business model
4. Awareness on National and state level institution of entrepreneurship concern

UNIT-I Entrepreneurship:

Entrepreneur characteristics, Classification of Entrepreneurships, Role of Entrepreneurship in economic development, women entrepreneurs, Entrepreneurial Failures

UNIT-II Entrepreneurial Opportunities:

Design Thinking tools (Visualization, Journey mapping (or experience mapping),Value chain analysis, Mind mapping, Rapid concept development, Assumption testing, Prototyping, Customer co-creation , Learning launches Storytelling.

UNIT -III: Planning and Evaluation of Projects:

Growth of Firm – Project identification and selection - Factors inducing growth- - Project Feasibility Study - Post Planning of Project-Project Planning and Control.

UNIT -IV Institutions Supporting Entrepreneurship:

NABARD, SIDBI, NIC, KVIC, SIDO; NSIC, DICs, SFC, SSIDC, NIESBUD, Angel investors, Crowdfunding. EDII, venture capital.

UNIT -V Institutional Support to Entrepreneur and MSMEs:

MSME , Government Policy and Taxation Benefits - Government Policy for SSIs tax Incentives and Concessions-Non-tax Concessions-Rehabilitation and Investment Allowances. MSME INSIDER.

Text Books:

1. Arya Kumar, Entrepreneurship, Pearson, Delhi, 2012.
2. Poornima M. Ch Entrepreneurship Development--Small Business Enterprises, Pearson, 2009 3. Michael H. Morris, et. Al., Entrepreneurship and Innovation, Cengage Learning, New Delhi,2011
3. KanishkaBedi , Management and Entrepreneurship, Oxford University Press, Delhi, 2009

References:

1. Ries, E. (2011). The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Crown Business.

2. Osterwalder, A., Pigneur, Y., In Clark, T., & Smith, A. (2010). Business model generation: A handbook for visionaries, game changers, and challengers.

3. Designing for Growth: A Design Thinking Tool Kit for Managers Book by Jeanne Liedtka and Tim Ogilvie

Web links : Download Latest Edition | Ministry of Micro, Small & Medium Enterprises (msme.gov.in)

What is Design Thinking and Why Is It So Popular? | Interaction Design Foundation (IxDF) (interaction-design.org)

The Lean Startup | The Movement That Is Transforming How New Products Are Built And Launched Business Model Canvas – Download the Official Template (strategyzer.com

B.Tech. IV Year II Semester

Course Structure

L	T	P	C
2	0	0	2

IoT and its Applications

Internal Marks : 40

Course Code: P18CSO07 **External Marks: 60**

Course Prerequisites: Nil

Course Objectives:

1. To provide an overview on the ICT ecosystem and enabling environment to foster Internet of Things (including technology, standards, system management and applications) deployments.
2. Define the infrastructure for supporting IoT deployments.
3. To provide an understanding of the technologies and the standards relating to the Internet of Things.
4. Understand various case studies related to IoT domain.

Course Outcomes:

1. Understand the technology and standards relating to IoTs.
2. Understand where the IoT concept fits within the broader ICT industry and possible future trends.
3. Understand the key components that make up an IoT system.
4. Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
5. Configure Raspberry Pi, Understand Sensors, Actuators & get started with python on Raspberry Pi.
6. Apply the knowledge and skills acquired during the course to design, build and test a complete, working IoT system involving prototyping, programming and data analysis.

UNIT I: (6 Lectures)

IoT Introduction & Concepts: Introduction to Internet of Things - Physical Design of IoT - Logical Design of IoT - IoT Enabling Technologies - IoT Levels & Deployment Templates.

UNIT II: (6 Lectures)

Domain Specific IoTs: Home Automation – Cities – Environment – Energy – Retail – Logistics - Agriculture – Industry - Health & Lifestyle.

UNIT III: (6 Lectures)

IoT and M2M: Introduction – M2M – Difference between IoT an M2M - Software Defined Networking - Network Function Virtualization for IoT. Developing Internet of Things: IoT Design Methodology – Motivation for using Python.

UNIT IV: (6 Lectures)

IoT Physical Devices & Endpoints: IoT Device – Raspberry Pi Board - Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming raspberry Pi with Python – Other IoT devices.

UNIT V: (6 Lectures)

Case Studies Illustrating IoT Design: Home Automation – Cities – Environment – Agriculture – Productivity applications.

Text Books:

1. Vijay Madisetti – Arshdeep Bahga, Internet of Things a Hands-on Approach, ArshdeepBahga & Vijay Madisetti ,1st Edition, 2014.
2. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press,1stEdition, 2014.

References:

1. Raj Kamal, Embedded Systems, Tata McGraw-Hill Education, 2ndEdition, 2011.
2. Adrian McEwen & Hakim Cassimally, Designing of Internet of Things, John Wiley and sons Ltd, 1st Edition, 2014,
3. Daniel Kellmereit - Daniel Obodovski, The Silent Intelligence: The Internet of Things, DnD Ventures, 1st Edition,2013.

IV B.Tech II Semester **Course Structure**

L	T	P	C
3	0	0	2

DISASTER MANAGEMENT

Course code: P21MCT02 **External Marks: 100**

Course prerequisites: Environmental Science

Course Objectives

1. Study of different kind of disasters.
2. Study about Development for Vulnerability Reduction Development for Vulnerability Reduction.
3. Learn Preparedness, safety measures.
4. Learn Psychological Response and Management.
5. Study Rehabilitation, Reconstruction and Recovery.

Course outcomes

1. Understand different kind of disasters.
2. Analyze Development for Vulnerability Reduction Development for Vulnerability Reduction.
3. Apply Preparedness, safety measures.
4. Apply Psychological Response and Management.
5. Analyze Rehabilitation, Reconstruction and Recovery.

UNIT I: INTRODUCTION TO DISASTE (5 Lectures)

Different Types of Disasters: Natural Disasters: Flood, Cyclone, Earthquakes, Landslides etc. Man-made Disaster: Fire, Industrial disasters. Pollution, Nuclear Disasters, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War &Terrorism. Causes, effects and practical examples for all disasters.

UNIT II: RISK AND VULNERABILITY ANALYSIS (5 Lectures)

Risk: Its concept and analysis. Risk Reduction. Vulnerability: Its concept and analysis. Strategic Development for Vulnerability Reduction

UNIT III: DISASTER PREPAREDNESS (6 Lectures)

Preparedness-Disaster Preparedness: Concept and Nature. Disaster Preparedness Plan. Prediction, Early Warnings and Safety Measures of Disaster. Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies. Role of IT in Disaster Preparedness. Role of Engineers on Disaster Management.

UNIT IV: DISASTER RESPONSE (7 Lectures)

Disaster Response: Introduction, Disaster Response Plan. Communication, Participation, and Activation of Emergency Preparedness Plan. Search, Rescue, Evacuation and Logistic Management. Role of Government, International and NGO Bodies, Psychological response and Management (Trauma, Stress, Rumor and Panic), Relief and Recovery Medical Health Response to Different Disasters.

UNIT V: REHABILITATION, RECONSTRUCTION AND RECOVERY (7 Lectures)

Reconstruction and Rehabilitation by Means of Development. Damage Assessment. Post Disaster effects and Remedial Measures. Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction Sanitation and Hygiene. Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning Roleof Educational Institute.

Text Books

1. Dr. Mrinalini Pandey, Disaster Management, Wiely India Pvt. Ltd.
2. Tushar Bhattacharya, Disaster Science and Management, Mc. Graw Hill Education (India) Pvt. Ltd.
3. Jagbir Singh, Disaster Management: Future Challenges and Opportunities, KW Publishers Pvt. Ltd.
4. J.P.Singhal, Disaster Management, Laxmi Publications.
5. Shailesh Shukla, Shamna Hussain, Biodiversity, Environment and DisasterManagement, Unique Publications
6. C. K. Rajan, Navale Pandharinath, Earth and Atmospheric Disaster Management: Nature and Manmade, BS Publications.

References

1. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012.
2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
3. Guerisse P. 2005 Basic Principles of Disaster Medical Management. Act Anaesth. Belg;56:395-401
4. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.
5. Sphere Project (2011). Humanitarian Charter and Minimum Standards in Disaster Response

Web References

1. http://www.sphereproject.org/ handbook/
2. http://www.wbnsou.ac.in/student_zone