ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

MECHANICAL NGINEERING

For

5 YEAR INTEGRATED DUAL DEGREE PROGRAM (I.D.P)

Leading to

(B.TECH. & M.Tech. / MBA)

(Applicable for the batches admitted from 2017-2018)

JNTUH COLLEGE OF ENGINEERING HYDERABAD

(Autonomous)

Kukatpally, Hyderabad – 500085

Telangana, India

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ACADEMIC REGULATIONS 2017
for CBCS Based 5 YEAR INTEGRATED DUAL DEGREE PROGRAM (B.Tech. & M.Tech/MBA)

(Effective for the students admitted into I year from the Academic Year **2017-18** and onwards)

1.0 5 Year Integrated Dual Degree Program in Engineering & Technology (IDP)

JNTUH offers 5 Year (10 Semesters) Integrated Dual Degree (IDP) Programme, under Choice Based Credit System (CBCS) at its Constituent Autonomous College - JNTUH College of Engineering Hyderabad, with effect from the Academic Year 2017 - 18 onwards, in the following Branches of Engineering

S.No.	UG Program	PG Program	
		M.Tech. (Specialization)	***MBA (Specialization)****
1)	B.Tech. in Electronics & Communication Engineering	M.Tech. (Communications & Signal Processing)	MBA (Human Resources / Finance/ Marketing/ Systems)
2)	B.Tech. in Computer Science & Engineering	M.Tech. (Computer Science)	MBA (Human Resources / Finance/ Marketing/ Systems)
3)	B.Tech. in Electrical & Electronics Engineering	M.Tech. (Power Electronics)	MBA (Human Resources / Finance/ Marketing/ Systems)
4)	B.Tech. in Mechanical Engineering	M.Tech. (Manufacturing Systems)	MBA (Human Resources / Finance/ Marketing/ Systems)
5)	B.Tech. in Civil Engineering	M.Tech. (Structural Engineering)	MBA (Human Resources / Finance/ Marketing/ Systems)

(* A Minimum of 15 students is necessary for any specialization to be offered.)

A student would be conferred the B.Tech Degree and M.Tech or MBA Degree in this IDP, after the successful completion of all the requirements for th 10 semesters of study and earning the appropriate credits.

2.0 Eligibility for Admission

2.1 Admission to the IDP shall be made either on the basis of the merit rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (EAMCET), OR the University, OR on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

2.2 The medium of instructions for the entire IDP in E&T will be ENGLISH only.

2.3 Students opting for the 5 year integrated IDP must specify their choice for M.Tech. (with in the specializations given above) or MBA as the case may be, after choosing the appropriate Branch of Engineering, at the time of Admissions only. Option thus exercised is final, and cannot be changed during the study period.

2.4 Students opting for 5 years integrated IDP have to study for the specified period, to earn the relevant credits for the award of both the B.Tech. and M.Tech. / MBA Degrees, and they will not be permitted to have a choice for B.Tech. Degree alone after 4 years study.

3.0 IDP Structure

3.1 The IDP Programmes of JNTUH-CEH are of Semester Pattern, with 10 Semesters constituting 5 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations, which are as listed below.

3.3 Semester Scheme:
Each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC.

3.4 Credit Courses:
All Subjects/ Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/ Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practicals Periods : Credits) Structure, based on the following general pattern ..

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L) Courses; and,

- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses or Tutorials (T).
  Other student activities like NCC, NSS, NSO, Study Tour, Guest Lecture etc., and identified Mandatory Courses will not carry Credits.

3.5 Subject/ Course Classification:
All Subjects/ Courses offered for the UGP are broadly classified as : (a) Foundation Courses (FnC), (b) Core Courses (CoC), and (c) Elective Courses (EℓC).

- Foundation Courses (FnC) are further categorized as : (i) HS (Humanities and Social Sciences), (ii) BS (Basic Sciences), and (iii) ES (Engineering Sciences);

- Core Courses (CoC) and Elective Courses (EℓC) are categorized as PS (Professional Subjects), which are further subdivided as – (i) PC (Professional/ Departmental Core) Subjects, (ii) PE (Professional/ Departmental Electives) , (iii) OE (Open Electives); and (iv) Project Works (PW);

- Minor Courses (1 or 2 Credit Courses, belonging to HS/ BS/ ES/ PC as per relevance); and
- Mandatory Courses (MC - non-credit oriented).

3.6 Course Nomenclature:

The Curriculum Nomenclature or Course-Structure Grouping for the each of the IDP E&T is as listed below :

S.No.	**UG/PG Program**	***Group/Category/Component***	***Description***
1)	UG	BS – Basic Sciences	Includes - Mathematics, Physics and Chemistry Subjects
2)	UG	ES - Engineering Arts and Sciences	Include fundamental engineering subjects

3)	UG	HS – Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4)	UG	PC – Professional Core	Includes core subjects related to the parent discipline, department or branch of engineering
5)	UG	PE – Professional Electives	Includes Elective subjects related to the parent discipline, department or branch of engineering
6)	UG	OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline, department or branch of engineering
7)	UG	Project	B.Tech. Project or UG Project or UG Major Project
8)	UG	Industrial Training/ Mini Project	Industrial Training/ Internship/ UG Mini Project/ Mini Project
9)	PG	PGC	PG Core Subjects related to the M.Tech. Specialization / MBA
10)	PG	PGE	PG Elective Subjects related to the M.Tech. Specialization / MBA
11)	PG	Project	PG Project M.Tech. / MBA
12)	PG	Seminar	Seminar / Colloquium at PG level, in M.Tech. / MBA
13)	PG	Comprehensive Viva	Comprehensive Viva based on all Subjects
		Total	**254**

4.0 Course Work

4.1 A student, after securing admission, shall pursue the IDP (B.Tech+M.Tech or MBA) in a minimum period of 5 Academic Years, and a maximum period of 10 Academic Years (starting from the Date of Commencement of I Year).
The entire course of study is of five academic years, comprising of 10 semesters. **All the I, II, III, IV and V years are on two-semester pattern.**

4.2 Each student shall Register for and Secure the specified number of Credits required for the completion of the IDP and Award of the B.Tech+M.Tech / MBA. Degree in respective Branch of Engineering.

4.3 The student must secure a total of 260 credits for the IDP - 174 credits for the B.Tech. Degree Program, plus 86 credits for the M.Tech./ MBA Program.

4.4 The course work and curriculum for first 3 years (6 Semesters) would be same as that the Regular B.Tech (4 year) in the relevant branch of Engineering.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the IDP, its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

5.2 Academic Section of the College invites 'Registration Forms' from students before the beginning of the Semester, through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examiantions) of the 'PRECEDING SEMESTER'.

5.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

5.4 A Student may be permitted to Register for his Subjects/ Course of CHOICE upto III year II semester with a typical total of 24 Credits per Semester (Minimum being 20 C and Maximum being 28 C, permitted deviation being ± 17%), based on his PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM of 20 Credits per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

A Student may be permitted to Register for his Subjects/ Course of CHOICE in IV year I semester and V year I semester with a typical total of 30 Credits per Semester (Minimum being 26 C and Maximum being 34 C, permitted deviation being ± 14%), based on his PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM of 26 Credits per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

A Student may be permitted to Register for his Subjects/ Course of CHOICE in IV year II semester with a typical total of 28 Credits per Semester (Minimum being 24 C and Maximum being 32 C, permitted deviation being ± 14%), based on his PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses, in the Department Course Structure and Syllabus contents. However, a MINIMUM of 24 Credits per Semester must be registered to ensure the 'STUDENTSHIP' in any Semester.

A Student must Register for his Subjects/ Course in V year II semester with a total of 22 Credits per Semester.

5.5 Open Electives: Students are to register One Open Elective (OE-I) during III Year I Semester, one (OE-II) during III Year II Semester , from the list of Open Electives given. However, Students can not opt for an Open Elective Subject offered by their own (parent) Department, if it is already listed under any category of the Subjects offered by parent Department in any Semester.

5.6 There shall be an Industry oriented Mini-Project, in collaboration with an Industry of the relevant specialization, to be registered immediately after III year II semester examinations, and taken up during the summer vacation for about eight weeks duration.

5.7 Each Student shall Register the UG Project Work during the IV Year II Semester, as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of Department.

5.8 The PG Project shall start immediately after the completion of the IV Year II Semester, and shall continue through V Year I and II Semesters as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of Department and registered after approval from PRC.

5.9 Choice for 'additional Subjects/ Courses' to reach the Maximum Permissible Limit of 28/32/34 Credits (above the typical 24/28/30 Credit norm) must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/ Counselor.

5.10 If the Student submits ambiguous choices or multiple options or erroneous entries - during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

5.11 Subject/ Course Options exercised through ON-LINE Registration are final and CAN NOT be changed, and CAN NOT be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or

for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5.12 Cancelation of Registration of Subjects/ Courses may be permitted, ONLY AFTER obtaining prior approval from the Faculty Advisor (subject to retaining a minimum of required credits) 'within 15 Days of Time' from the beginning of the current Semester.

6.0 Subjects/ Courses to be offered

6.1 A Subject/ Course may be offered to the Students, ONLY IF a Minimum of 1/3 of the class Strength opt for the same. The Maximum Strength of a class is limited to 80 (60 + 1/3 of the class Strength).

6.2 More than ONE TEACHER may offer the SAME SUBJECT (Lab./ Practicals may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection choice for students will be based on - 'FIRST COME FIRST SERVE Basis and CGPA Criterion' (ie., the first focus shall be on early ON-LINE ENTRY from the student for Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

6.3 If more entries for Registration of a Subject come into picture, then the concerned Head of Department shall take necessary action, whether to offer such a Subject/ Course for TWO (or multiple) SECTIONS or NOT .

6.4 In case of options coming from Students of other Departments/ Branches/ Disciplines (not considering OPEN ELECTIVES), PRIORITY shall be given to the student of the 'Parent Department' first.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations upto III year II semester, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/ Courses (excluding Mandatory or Non-Credit Courses) for that Semester.

A student shall be eligible to appear for the End Semester Examinations in IV and V year , I Semester and II Semester, if he acquires a minimum of 75% of attendance in that subject.

7.2 Condoning of shortage of attendance is up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student's representation with supporting evidence.

7.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

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

7.5 Students, whose shortage of attendance is not condoned in any Semester, are not eligible to take their End Examinations of that Semester; they get detained and their registration for that Semester shall stand cancelled. They will not be promoted to the next Semester. They may seek re-registration for all those Subjects registered in that Semester in which he got detained, by seeking re-admission for that Semester as and when offered; in case if there are any Professional Electives and/ or Open Electives, the same may also be re-registered if offered, however, if those Electives are not offered in later Semesters, then alternate Electives may be chosen from the SAME set of Elective Subjects offered under that category.

7.6 Students from IV year I semester onwards, whose shortage of attendance is not condoned in any Subjecr, are not eligible to take their End Examinations of that Subject, they get detained and their registration for that Subject shall stand cancelled. They may seek re-registration for all those Subjects registered in which they got detained, by seeking re-regiter for that Subjects as and when offered.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No.**7.**

8.1 (a) **UG Part**

A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 35% marks (25 out of 70 marks) in the End Semester Examination, and a minimum of 40% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing P Grade or above in that Subject/ Course.

A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Industry oriented Mini-Project/ Seminar, if he secures not less than 40% of the total marks (40 marks) to be awarded for each. The student would be treated as failed, if he - (i) does not submit a report on his Industry oriented Mini-Project, or does not make a presentation of the same before the Evaluation Committee as per schedule, or (ii) does not present the Seminar as required in the IV year II Semester, or (iii) secures less than 40% of marks (40 marks) in Industry oriented Mini-Project/ Seminar evaluations.
He may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent Semester, as and when it is scheduled.

(b) **PG Part**

A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 40% Marks (28 out of 70 Marks) in the End Semester Examination, and a minimum of 50% of Marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing B Grade or above in that Subject.

A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Seminar, and Comprehensive Viva-voce, if he secures not less than 50% of the total Marks to be awarded for each. The Student would be treated as failed, if he - (i) does not attend the Comprehensive Viva-voce as per the schedule given, or (ii) does not present the Seminar as required, or (ii) secures less than 50% of Marks (< 50 Marks) in –Seminar/ Comprehensive Viva-voce evaluations.
He may reappear for comprehensive viva where it is scheduled again; For seminar, he has to reappear in the next subsequent Semesters, as and when scheduled.

8.2 A Student will not be promoted from I Year to II Year, unless he fulfils the Attendance and Academic Requirements and secures a total of 24 Credits out of 48 Credits i.e. 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

8.3 A Student will not be promoted from II Year to III Year, unless he fulfils the Attendance and Academic Requirements and secures a total of 58 Credits out of 96 Credits i.e. 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

8.4 A Student will not be promoted from III Year to IV Year, unless he fulfils the Attendance and Academic Requirements and secures a total of 86 Credits out of 144 Credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

A student shall be promoted from IV Year to V Year, if the student completes the UG Project satisfactorily and earns the prescribed number of credits for UG Project by the end of IV Year II Semester.

8.5 A Student shall - register for all Subjects covering 254 Credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, put up all the Attendance and Academic requirements for 254 Credits securing a minimum of P / B Grade (Pass Grade) or above in each Subject, and 'earn ALL 254 Credits securing SGPA $\geq$ 5.0 / 6.0 (in each Semester), and CGPA (at the end of each successive Semester) $\geq$ 5.0/ 6.0, to successfully complete the UGP and PGP.

8.6 If a Student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 254 Credits as specified in the Course Structure of his Department, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 254 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 7 and 8.1 – 8.4 above.

8.7 Students who fail to earn 254 Credits as per the Course Structure, and as indicated above, within 10 Academic Years from the Date of Commencement of their I Year shall forfeit their seats in IDP Programme and their admissions shall stand cancelled.

8.8 When a Student is detained due to shortage of attendance in any Semester, he may be re-admitted into that Semester, as and when offered, with the Academic Regulations of the Batch into which he gets readmitted. However, no Grade Allotments or SGPA/ CGPA calculations will be done for that entire Semester in which he got detained.

8.9 When a Student is detained due to lack of Credits in any year, he may be readmitted in the next year, after fulfilment of the Academic Requirements, with the Academic Regulations of the Batch into which he gets readmitted.

8.10 A student eligible to appear in the End Semester Examination in any Subject/ Course, but absent at it or failed (thereby failing to secure P Grade or above), may reappear for that Subject/ Course at the supplementary examination / SEE as and when conducted. In such cases, his Internal Marks assessed earlier for that Subject/ Course will be carried over, and added to the Marks to be obtained in the supplementary examination/SEE, for evaluating his performance in that Subject.

9.0 Evaluation - Distribution and Weightage of Marks

(a) UG Part

9.1 The performance of a student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory or Practicals or Seminar or Drawing/Design or Industry oriented Mini-Project or Minor Course, etc; For all Subjects/ Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE. However, the UG Project Work (Major Project) will be evaluated for 200 Marks. These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % marks obtained shall be given.

9.2 a) For Theory Subjects (inclusive of Minor Courses), during the Semester, there shall be 2 mid-term examinations for 25 marks each. Each mid-term examination consists of one objective paper for 10 marks, plus one subjective paper for 15 marks, with a duration of 120 minutes (20 minutes for objective and 100 minutes for subjective papers). Further, there will be an allocation of 5 marks for Assignment. Objective paper may be set with multiple choice questions, True/ False, fill-in the blanks, matching type questions, etc. Subjective paper shall contain 5 questions, out of which the Student has to answer 3 questions, each for 5 marks.

b) The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

c) First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second mid-term examinations. The Assignments shall be as specified by the concerned subject teacher.

d) The first mid-term examination Marks and first Assignment Marks shall make one set of CIE Marks , and the second mid-term examination Marks and second Assignment Marks shall make second set of CIE Marks; and the better of these two sets of marks shall be taken as the final marks secured by the Student towards Continuous Internal Evaluation in that Theory Subject.

9.3 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks, and 70 marks are assigned for Lab./Practical End Semester Examination (SEE). Out of the 30 marks for internals, day-to-day work in the laboratory shall be evaluated for 20 marks; and for the remaining 10 marks - two internal practical tests (each of 10 marks) shall be conducted by the concerned laboratory teacher and the better of these two tests is taken into account. The SEE for Practicals shall be conducted at the end of the Semester by Two Examiners appointed by Head of the Department.

9.4 For the Subjects having Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (20 marks for day-to-day work, and 10 marks for internal tests) and 70 marks for SEE. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.

9.5 The Industry oriented Mini-Project shall be submitted in a Report form, and a presentation of the same shall be made before a Committee, which evaluates it for 100 marks. The Committee shall consist of Head of the Department, the supervisor of Mini-Project, and a Senior Faculty Member of the Department. There shall be no internal marks for Industry oriented Mini-Project. The Mini-Project shall be evaluated in the IV Year I Semester.

9.6 Out of a total 200 marks allotted for the Project Work, 60 marks shall be for CIE (Continuous Internal Evaluation and 140 marks for the SEE (End Semester Viva-voce Examination). The Project Viva-voce shall be conducted by a Committee comprising of an External Examiner, Head of the Department, Senior faculty and Project Supervisor. Out of 60 marks allocated for CIE, 30 marks shall be awarded by the Project Supervisor (based on the continuous evaluation of student's performance throughout the Project Work period), and the other 30 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, based on the work carried out and the presentation made by the Student at the time of Viva-voce Examination.

9.7 For NCC/ NSS/ NSO types of Courses, and/or any other Mandatory Non-Credit Course offered in a Semester, a 'Satisfactory Participation Certificate' shall be issued to the Student from the concerned authorities, only after securing ≥ 65% attendance in such a Course. No marks or Letter Grade shall be allotted for these activities.

(b) PG Part (M.Tech.)

9.8 The performance of a Student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 Marks for Theory or Practicals or Seminar or Drawing/Design or Comprehensive Viva-voce etc; These evaluations shall be based on 30% CIE (Continuous Internal Evaluation) and 70% SEE (Semester End Examination), and a Letter Grade corresponding to the % Marks obtained shall be given.

i) For Theory Subjects, CIE Marks shall comprise of - Mid-Term Examination Marks (for 25 Marks), and Assignment Marks (for 5 Marks).

ii) During the Semester, there shall be 2 Mid-Term examinations. Each Mid-Term examination shall be for 25 Marks (120 minutes duration). The better performance out of these two Mid-Term Examinations shall be considered for the award of 25 Marks.

9.9 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 Internal Marks, and 70 Marks are assigned for Lab./Practicals End Semester Examination (SEE). Out of the 30 Marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 20 Marks; and the performance in an internal Lab./Practical Test shall be evaluated for 10 marks. The SEE for Lab./ Practicals shall be conducted at the end of the Semester by the concerned Laboratory Teacher and another faculty member of the same Department as assigned by the Head of the Department.

9.10 There shall be a Seminar Presentation in V Year I Semester. For the Seminar, the Student shall collect the information on a specialized topic, prepare a Technical Report and submit to the Department at the time of Seminar Presentation. The Seminar Presentation (along with the Technical Report) shall be evaluated by Two Faculty Members assigned by Head of the Department, for 100 Marks. There shall be no SEE or External Examination for Seminar.

9.11 Each Student shall appear for a Comprehensive Viva-Voce at the end of the V Year II Semester. The Comprehensive Viva-Voce shall be conducted by a Committee, consisting of three senior faculty members of Department nominated by the Head of the Department, and the performance evaluation shall be for 100 Marks. There are no Internal Marks for the Comprehensive Viva-voce.

9.12 i) The PGP Project shall start immediately after the completion of the IV Year II Semester, and shall continue through V Year I and II Semesters after approval of PRC. The Student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 6 weeks (immediately after his IV Year II Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of Department, and shall consist of the Head of Department, Project Supervisor, and a Senior Faculty Member of the Department. The Student shall present his Project Work Proposal to the PRC (PRC-I Presentation), on whose approval he can 'REGISTER for the PG Project'. After Registration, the Student shall carry out his work, and continually submit 'a fortnightly progress report' to his Supervisor throughout the Project period. The PRC will monitor the progress of the Project Work and review, through PRC-II and PRC-III Presentations – one at the end of the V Year I Semester, and one before the submission of M.Tech. Project Work Report/ Dissertation.

ii) After PRC-III presentation, the PRC shall evaluate the entire performance of the Student and declare the Project Report as 'Satisfactory' or 'Unsatisfactory'. Every Project Work Report/ Dissertation (that has been declared 'satisfactory') shall undergo 'Plagiarism Check' as per the University/ College norms to ensure content plagiarism below a specified level of 30%, and to become acceptable for submission. In case of unacceptable plagiarism levels, the student shall resubmit the Project Work Report,

after carrying out the necessary modifications/ additions to his Project Work/ Report as per his Supervisor's advice, within the specified time, as suggested by the PRC.

iii) If any Student could not be present for PRC-II at the scheduled time (after approval and registration of his Project Work at PRC-I), his submission and presentation at the PRC-III time (or at any other PRC specified dates) may be treated as PRC-II peformance evaluation, and delayed PRC-III dates for him may be considered as per PRC recommendations. Any Student is allowed to submit his M.Tech. Project Dissertation 'only after completion of 40 weeks from the date of approval/registration' of his Project, and after obtaining all approvals from the PRC.

iv) A total of 200 Marks are allotted for the M.Tech. Project Work, (out of which 100 Marks are allotted for internal evaluation and 100 Marks for external evaluation). For internal Evaluation of 100 marks, Project Supervisor shall evaluate for 60 marks based on the continuous Internal Evaluation(CIE) of the student's performance and combined PRC-I, II & III performance evaluation will be for 40 marks (to be awarded by PRC, as SEE).

9.13 i) The Student shall be allowed to submit his Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Labs.), Seminar, Comprehensive Viva-voce etc. (securing B Grade or above), and after obtaining all approvals from PRC. In such cases, the M.Tech. Dissertations will be sent to an External Examiner nominated by the Principal of the College, on whose 'approval', the Student can appear for the M.Tech. Project Viva-voce Examination, which shall be conducted by a Board, consisting of the PG Project Supervisor, Head of the Department, and the External Examiner who adjudicate the M.Tech. Project Work and Dissertation. The Board shall jointly declare the Project Work Performance as 'satisfactory', or 'unsatisfactory'; and in successful cases, the External Examiner shall evaluate the Student's Project Work presentation and performance for 100 Marks (SEE).

ii) If the adjudication report of the External Examiner is 'not favourable' , then the Student shall revise and resubmit his Dissertation after one Semester, or as per the time specified by the External Examiner and/ or the PRC. If the resubmitted report is again evaluated by the External Examiner as 'not favourable', then that Dissertation will be summarily rejected. Subsequent actions for such Dissertations may be considered, only on the specific recommendations of the External Examiner and/ or PRC.

iii) In cases, where the Board declared the Project Work Performance as 'unsatisfactory', the Student is deemed to have failed in the Project Viva-voce Examination, and he has to reappear for the Viva-voce Examination as per the Board recommendations. If he fails in the second Viva-voce Examination also, he will not be considered eligible for the Award of the Degree, unless he is asked to revise and resubmit his Project Work by the Board within a specified time period (within 5 years from the date of commencement of his I Year I Semester).

(c) PG Part (MBA)

10.1 Theory Subjects are evaluated for 100 marks, and Practicals / Lab. Subjects are also evaluated for 100 marks.

10.2 PG Summer Internship, Seminar and Comprehensive Viva-voce shall be evaluated for100 marks each.

10.3. There shall be a PG Summer Internship, preferably in an industry, to be taken up during the vacation, immediately after the IV year II Semester End Examinations. The Internship Activity shall be submitted in a Report form, and the student shall also deliver a Seminar (based on the PG Summer Internship) before the MBA Project Evaluation Committee (PEC); both the Report and the Seminar shall be evaluated for 100 marks each by the PEC, at the beginning of the V Year I Semester. The PEC shall be constituted by the Head of Dept. or Principal/Director of the College/School, and shall consist of the Head of the Department, the

Supervisor of PG Summer Internship Program/Seminar/PG Project and a Senior Faculty Member of the Department. There shall be no internal marks for this PG Summer Internship Program.

10.4 For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For the award of the 30 Internal (sessional) marks for theory subjects, there shall be 2 internal examinations during the Semester, one at the middle of the Semester and the other immediately after the completion of instructions; each of which shall be evaluated for 25 marks, and the **better** of these two internals shall be considered for awarding the 25 sessional marks. The remaining 5 sessional marks, will be awarded based on the student's performance in the Assignments.

10.5 i) Every PGP Student shall be required to execute his MBA Project, under the guidance of the Supervisor assigned to him by the Head of Department. The PGP Project shall start immediately after the completion of the V Year I Semester, and shall continue through V Year II Semesters. The Student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 6 weeks (immediately after his V Year I Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of Department, and shall consist of the Head of Department, Project Supervisor, and a Senior Faculty Member of the Department. The Student shall present his Project Work Proposal to the PRC (PRC-I Presentation), on whose approval he can 'REGISTER for the PG Project'. Every Student must compulsorily register for his MBA Project Work, within the 6 weeks of time-frame as specified above. After Registration, the Student shall carry out his work, and continually submit 'a fortnightly progress report' to his Supervisor throughout the Project period. The PRC will monitor the progress of the Project Work and review, through PRC-II and PRC-III Presentations – one at the end of the V Year II Semester, and one before the submission of MBA Project Work Report/ Dissertation.

ii) After PRC-III presentation, the PRC shall evaluate the entire performance of the Student and declare the Project Report as 'Satisfactory' or 'Unsatisfactory'. Every Project Work Report/ Dissertation (that has been declared 'satisfactory') shall undergo 'Plagiarism Check' as per the University/ College norms to ensure content plagiarism below a specified level of 30%, and to become acceptable for submission. In case of unacceptable plagiarism levels, the student shall resubmit the Project Work Report, after carrying out the necessary modifications/ additions to his Project Work/ Report as per his Supervisor's advice, within the specified time, as suggested by the PRC.

iii) If any Student could not be present for PRC-II at the scheduled time (after approval and registration of his Project Work at PRC-I), his submission and presentation at the PRC-III time (or at any other PRC specified dates) may be treated as PRC-II peformance evaluation, and delayed PRC-III dates for him may be considered as per PRC recommendations. Any Student is allowed to submit his MBA Project Dissertation 'only after completion of **24 weeks** from the date of approval/registration' of his Project, and after obtaining all approvals from the PRC.

iv) A total of 200 Marks are allotted for the MBA Project Work, (out of which 100 Marks are allotted for internal evaluation and 100 Marks for external evaluation). For internal Evaluation of 100 marks, Project Supervisor shall evaluate for 60 marks based on the continuous Internal Evaluation(CIE) of the student's performance and combined PRC-I, II & III performance evaluation will be for 40 marks (to be awarded by PRC, as SEE).

10.6 i) The Student shall be allowed to submit his Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Labs.), Seminar, Comprehensive Viva-voce etc. (securing B Grade or above), and after obtaining all approvals from PRC. In such cases, the MBA. Dissertations will be sent to an External Examiner nominated by the Principal of the College, on whose 'approval', the Student can appear for the MBA. Project Viva-voce Examination, which shall be conducted by a Board, consisting of the PG Project Supervisor, Head of the Department, and the External Examiner who adjudicated the MBA Project Work and

Dissertation. The Board shall jointly declare the Project Work Performance as 'satisfactory', or 'unsatisfactory'; and in successful cases, the External Examiner shall evaluate the Student's Project Work presentation and performance for 100 Marks (SEE).

ii) If the adjudication report of the External Examiner is 'not favourable' , then the Student shall revise and resubmit his Dissertation after one Semester, or as per the time specified by the External Examiner and/ or the PRC. If the resubmitted report is again evaluated by the External Examiner as 'not favourable', then that Dissertation will be summarily rejected. Subsequent actions for such Dissertations may be considered, only on the specific recommendations of the External Examiner and/ or PRC.

iii) In cases, where the Board declared the Project Work Performance as 'unsatisfactory', the Student is deemed to have failed in the Project Viva-voce Examination, and he has to reappear for the Viva-voce Examination as per the Board recommendations. If he fails in the second Viva-voce Examination also, he will not be considered eligible for the Award of the Degree, unless he is asked to revise and resubmit his Project Work by the Board within a specified time period (within 5 years from the date of commencement of his I Year I Semester).

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10.7 There shall be a Comprehensive Viva at the end of the V year II Semester, for the award of 100 marks. The Comprehensive Viva-Voce shall be conducted by the PRC, with the addition of one more Senior Faculty Member of the Department/School. The Comprehensive Viva is aimed to assess the student's understanding in various subjects studied during the PG part of Dual Degree Program. There are no internal marks for the Comprehensive Viva.

11.0 Grading Procedure

11.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, or Mini-Project, Minor Course etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 9 above, and a corresponding Letter Grade shall be given.

11.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed …

(a) For UG

% of Marks Secured in a Subject / Course	Letter Grade As per UGC Guidelines	Grade Points
More than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B+ (Good)	7
50 and not less than 60%	B (Average)	6
40 and not less than 50%	C (Pass)	5
Below 40%	F (Fail)	0
Absent	Ab	0

(b) For PG

% of Marks Secured in a Subject / Course	Letter Grade As per UGC Guidelines	Grade Points
80% and above (≥ 80% , ≤ 100%)	O (Outstanding)	10
Below 80% but not less than 70% (≥ 70% , < 80%)	A^+ (Excellent)	9
Below 70% but not less than 60% (≥ 60% , < 70%)	A (Very Good)	8
Below 60% but not less than 55% (≥ 55% , < 60%)	B^+ (Good)	7
Below 55% but not less than 50% (≥ 50% , < 55%)	B (above Average)	6
Below 50% (< 50%)	F (FAIL)	0
Absent	Ab	0

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

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

11.5 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, he has to repeat all the Subjects/ Courses pertaining to that Semester, when he is detained (as listed in Items 8.8- 8.9).

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

11.7 The Student passes the Subject/ Course only when he gets GP ≥ 5 (for UG) / 6 (for PG)

11.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

$$\text{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ .... For each Semester,}$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the ith Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

11.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ ... for all S Semesters registered (ie., upto and inclusive of S Semesters, } S \geq 2 \text{),}$$

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

11.10 For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

11.11 For Calculations listed in Item 11.6 – 11.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/ Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

11.12 Passing Standards:

i) A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA ≥ 5.00/ 6.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UGP, only when gets a CGPA ≥ 5.00/ 6.00; subject to the condition that he secures a GP ≥ 5 (for UG) / 6 (for PG) in every registered Subject/ Course in each Semester (during the entire UGP/PGP) for the Degree Award, as required.

ii) In spite of securing P Grade or above in some (or all) Subjects/ Courses in any Semester, if a Student receives a SGPA < 5.00 / 6.00 and/ or CGPA < 5.00/ 6.00 at the end of such a Semester, then he 'may be allowed' (on the 'specific recommendations' of the Head of the Department and subsequent approval from the Principal) -

(a) to go into the next subsequent Semester (subject to fulfilling all other attendance and academic requirements as listed under Items 7-8);

(b) to 'improve his SGPA of such a Semester (and hence CGPA) to 5.00/ 6.00 or above', by reappearing for ONE or MORE (as per Student's choice) of the same Subject(s) / Course(s) in which he has secured P Grade(s) in that Semester, at the Supplementary Examinations to be held in the next subsequent Semester(s). In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

In these considerations, the newly secured Letter Grades will be recorded and taken into account for calculation of SGPA and CGPA, only if there is an improvement.

(iii) A Student shall be declared successful or 'passed' in any Non-Credit Subject/ Course, if he secures a 'Satisfactory Participation Certificate' for that Mandatory Course.

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

12.0 Declaration of Results

12.1 Computation of SGPA and CGPA are done using the procedure listed in 11.6 – 11.10.

12.2 For Final % of Marks equivalent to the computed final CGPA, the following formula may be used …

% of Marks = (final CGPA – 0.5) x 10

13.0 Award of Degree

13.1 A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire IDP E&T Programme and secures the required number of 174 for UGP and 80 Credits for PGP (with CGPA ≥ 5.0/ 6.0), within 10 Academic Years from the Date of Commencement of the First Academic Year, shall be declared to have 'QUALIFIED' for the Award of the B.Tech.+M.Tech /MBA Degree(UGP and PGP) in the chosen Branch of Engineering as selected at the time of Admission.

13.2 A Student who qualifies for the Award of UG + PG Degree as listed in Item 13.1 shall be placed in the following Classes …

13.3 Students with final CGPA (at the end of the IDP) for both UGP/ PGP ≥ 8.00/ 7.75, and fulfilling the following conditions -

(i) should have passed all the Subjects/Courses in 'FIRST APPEARANCE' within the first 5 Academic Years (or 10 Sequential Semesters) from the Date of Commencement of his First Academic Year,

(ii) should have secured a CGPA ≥ 8.00/ 7.75, at the end of each of the 10 Sequential Semesters, starting from the I Year I Semester onwards,

(iii) should not have been detained or prevented from writing the End Semester Examinations in any Semester due to shortage of attendance or any other reason, shall be placed in 'FIRST CLASS with DISTINCTION'.

Students having final CGPA (at the end of IDP) for both UGP/ PGP ≥ 8.00/ 7.75, but not fulfilling the above conditions shall be placed in 'FIRST CLASS'.

13.4 Students with final CGPA (at the end of the IDP) for UGP/ PGP ≥ 6.50/ 6.75 but < 8.00/ 7.75, shall be placed in 'FIRST CLASS'.

13.5 Students with final CGPA (at the end of the IDP) for both UGP/ PGP ≥ 5.50/ 6.00 but < 6.50/ 6.75, shall be placed in 'SECOND CLASS'.

13.6 All other Students who qualify for the Award of the Degree (as per Item 13.1), with final CGPA (at the end of the IDP) for UGP ≥ 5.00 but < 5.50, shall be placed in 'PASS CLASS'.

13.7 A student with final CGPA (at the end of the IDP) for UGP < 5.00 will not be eligible for the Award of the B. Tech Degree.

13.8 A student with final CGPA (at the end of the IDP) for PGP < 6.00 will not be eligible for the Award of the M. Tech / MBA Degree.

13.9 Students fulfilling the conditions listed under Item 13.1 alone will be eligible candidates for - 'University Rank' and 'Gold Medal' considerations.

14.0 Withholding of Results

14.1 If the student has not paid fees to University/ College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

15.0 Transitory Regulations

15.1 Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/ Courses (or equivalent Subjects/ Courses, as the case may be), and same Professional Electives/ Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 10 years from the Date of Commencement of his I Year I Semester).

16.0 Student Transfers

16.1 There shall be no Branch transfers after the completion of Admission Process.

16.2 There shall be no transfer among the Constituent Colleges and Units of Jawaharlal Nehru Technological University Hyderabad.

17.0 Scope

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her", "hers".

ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

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

v) The College may change or amend the Academic Regulations, Course Structure or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates notified by the College Authorities.

MALPRACTICE RULES

The following Malpractice rules are applicable to both Internal Examinations/SEE/Supplementory Examinations:

	Nature of Malpractices	Punishment
	If the candidate:	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
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/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for

		two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects

	connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a 8police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	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 / year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College / University for further action to award suitable punishment.	

JNTUH COLLEGE OF ENGINEERING HYDERABAD
(AUTONOMOUS)

5 Year Integrated Dual Degree Program (IDP)
(B.Tech. + M.Tech. / MBA)

MECHANICAL ENGINEERING

COURSE STRUCTURE
(Applicable from the batch admitted from the Academic Year 2017-18 and onwards)

I YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	BS	Mathematics - I	4	1	0	4
2	BS	Engineering Physics	3	1	0	3
3	BS	Applied Chemistry	3	1	0	3
4	ES	Computer Programming & Data Structures	4	1	0	4
5	ES	Classical Engineering Mechanics	4	1	0	4
6	BS	Engineering Physics Lab	0	0	3	2
7	BS	Applied Chemistry Lab	0	0	3	2
8	ES	Computer Programming & Data Structures Lab	0	0	3	2
		NSS/NCC/NSO				
		Total Credits				**24**

I YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	BS	Mathematics–II	3	1	0	3
2	ES	Fundamentals of Electrical & Electronics Engineering	3	0	0	3
3	HS	English	3	0	0	3
4	ES	Engineering Graphics	3	0	3	4
5	ES	Environmental Science	3	0	0	3
6	BS	Computational Mathematics	2	0	0	2
7	ES	Engineering Workshop	0	0	3	2
8	HS	English Language Communication Skills Lab	0	0	3	2
9	BS	Computational Mathematics Lab	0	0	3	2
		NSS/NCC/NSO				
		Total Credits				**24**

II YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	BS	Mathematics -III	4	1	0	4
2	PC	Metallurgy & Material Science	3	0	0	3
3	PC	Mechanics of Solids	3	1	0	3
4	PC	Thermodynamics	3	1	0	3
5	PC	Kinematics of Machines	3	1	0	3
6	PC	Machine Drawing practice	2	0	3	3
7	PC	Mechanics of Solids & Metallurgy Lab	0	0	3	1
8	PC	Fuels & lubricants Lab	0	0	3	2
9	HS	Human Values and Professional Ethics	2	0	0	2
		Total Credits				**24**

II YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PC	Fluid Mechanics & Hydraulic Machinery	4	1	0	4
2	PC	Thermal Engineering-I	4	1	0	4
3	PC	Dynamics of Machines	4	1	0	4
4	PC	Production Technology	3	0	0	3
5	PC	Instrumentation & Control Systems	3	0	0	3
6	HS	Gender Sensitization Lab	-	-	-	-
7	PC	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	2
8	PC	Instrumentation & control system Lab	0	0	3	2
9	PC	Production Technology Lab	0	0	3	2
		Total Credits				**24**

III YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	OE-I	Open Elective-I	3	0	0	3
2	HS	Managerial Economics and Financial Analysis	4	0	0	4
3	PC	Design of Machine Members-I	4	1	0	4
4	PC	Thermal Engineering -II	3	1	0	3
5	PC	Machine tools and Metrology	4	0	0	4
6	PC	Thermal Engineering Lab	0	0	3	2
7	PC	Machine tools and Metrology Lab	0	0	3	2
8	HS	Advanced English Language Communication Skills Lab	0	0	3	2
		Total Credits				**24**

III YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	OE-II	Open Elective-II	3	0	0	3
2	PE-I	Professional Elective-I	4	0	0	4
3	PE-II	Professional Elective– II	4	0	0	4
4	PC	Design of Machine Members-II	3	1	0	3
5	PC	Heat Transfer	4	1	0	4
6	PC	Kinematics & Dynamics Lab	0	0	3	2
7	PC	Heat Transfer Lab	0	0	3	2
8	PC	Advanced Thermodynamics Lab	0	0	3	2
		Total Credits				**24**

During Summer Vacation between III and IV Years: Industry Oriented Mini Project

IV YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PC (UG)	CAD/CAM	4	0	0	4
2	PE-III (UG)	Professional Elective-III	4	0	0	4
3	PGC-I	Advanced Manufacturing processes	4	0	0	4
4	PGE-I	PG Elective-I	4	0	0	4
5	PGE-II	PG Elective-II	4	0	0	4
6	PGE-III	PG Elective-III	4	0	0	4
7	PC (UG) Lab	CAD/CAM Lab	0	0	3	2
8	PGC Lab	Advanced Manufacturing Processes and Systems Lab	0	0	4	2
9	EAC (UG)	Industrial Training / Mini Project Evaluation (Summer Program)				2
		Total Credits				**30**

IV YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	HSS (UG)	Management Science	4	0	0	4
2	PGC-II	Optimization Techniques & Applications	4	0	0	4
3	PGE-IV	PG Elective-IV	4	0	0	4
4	PGC Lab	Advanced CAD & Analysis Lab	0	0	4	2
5	PC (UG)	Major Project				14
		Total Credits				**28**

V YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PGC-III	Automation in Manufacturing	4	0	0	4
2	PGE-V	PG Elective-V	4	0	0	4
3	PGE-VI	PG Elective-VI	4	0	0	4
4	PGE-VII	PG Elective-VII	4	0	0	4
5	PG	Project Stage – I				12
6	PG	Seminar	0	0	3	2
		Total Credits				**30**

V YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PG	PG Project Stage-II				18
2	PG	Comprehensive Viva				4
		Total Credits				**22**

Professional Elective-I
1. Automobile Engineering
2. Computer Graphics
3. Unconventional Machining Process
4. Industrial Engineering Practices

Professional Elective-II
1. Operations Research
2. Tribology
3. Power Plant Engineering
4. Fluid Power Systems

Professional Elective-III (UG)
1. Unconventional Machining Processes
2. Advance IC Engines
3. Refrigeration & Air Conditioning

PG Elective -I
1. Advanced Metal Forming
2. Vibration Analysis and Condition Monitoring
3. Design For Manufacturing Of MEMS

PG Elective -II
1. Theory Of Metal Cutting And Tool Design
2. Precision Engineering
3. Mechatronics

PG Elective-III
1. Product Design and Development
2. Value Engineering and Total Quality Management
3. Manufacturing Systems : Simulation Modeling & Analysis

PG Elective-IV
1. Advanced Finite Element & Boundary Methods
2. Quality Engineering in Manufacturing
3. Additive Manufacturing

PG Elective -V
1. Design For Manufacturing And Assembly
2. Production And Operations Management
3. Flexible Manufacturing Systems

PG Elective –VI
1. Advanced Casting And Welding Technology
2. Materials Technology
3. Industrial Robotics

PG Elective-VII
1. Nano Technology
2. Neural Networks and Fuzzy Logics
3. Scaling Laws and Micro Manufacturing

OPEN ELECTIVE- I		
S.No.	**Subject**	**Offering Department**
1	Disaster Management	Civil Engineering
2	Non – Conventional Power Generation	Electrical & Electronics Engineering
3	Electrical Engineering Materials	
4	Nano-Technology	
5	Operations Research	Mechanical Engineering
6	Basics of Thermodynamics	
7	Fabrication Processes	
8	Electronic Measuring Instruments	Electronics & Communication Engineering
9	OOPS through JAVA	Computer Science & Engineering
10	Computer Graphics	
11	Engineering Materials	Metallurgical Engineering
12	Metallurgy for Non Metallurgists	
13	Industrial Pollution Control Engineering	Chemical Engineering

OPEN ELECTIVE- II		
S.No.	**Subject**	**Offering Department**
1	Estimation, Quantity Survey & Valuation	Civil Engineering
2	Design Estimation and Costing of Electrical Systems	Electrical & Electronics Engineering
3	Energy Storage Systems	
4	Mechatronics	
5	Jet propulsion and Rocket Engineering	Mechanical Engineering
6	Ergonomics	
7	Mechatronics	
8	Principles of Electronic Communications	Electronics & Communication Engineering
9	Cyber Security	Computer Science & Engineering
10	Database Management Systems	
11	Corrosion Engineering	Metallurgical Engineering
12	Testing of Materials	
13	Solid Waste Management	Chemical Engineering

JNTUH COLLEGE OF ENGINEERING HYDERABAD
(AUTONOMOUS)
5 Year Integrated Dual Degree Program (IDP)
(B.Tech. + M.Tech. / MBA)

MECHANICAL ENGINEERING

COURSE STRUCTURE FOR MBA

(Applicable from the batch admitted from the Academic Year 2017-18 and onwards)

IV YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PC	CAD/CAM	4	0	0	4
2	PE-III (UG)	Professional Elective - III	4	0	0	4
3	HS (UG)	Management Science	4	0	0	4
4	PGC-I	Marketing Management	4	0	0	4
5	PGC-II	Human Resource Management	4	0	0	4
6	PGE-I	PG Elective-I	4	0	0	4
7	PC (UG) Lab	CAD/CAM Lab	0	0	3	2
8	PGC Lab	Soft Skills Lab	0	0	4	2
9	EAC (UG)	Industrial Training / Mini Project Evaluation (Summer Program)				2
		Total Credits				**30**

IV YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PGC-III	Research Methodology and Statistical Analysis	4	0	0	4
2	PGC-IV	Business Law and Regulation	4	0	0	4
3	PGE-II	PG Elective-II	4	0	0	4
4	PGC Lab	Statistical Analysis Lab using SPSS / Excel	0	0	4	2
5	PC (UG)	Major Project				14
		Total Credits				**28**

V YEAR **I SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PGC-V	Strategic Management	4	0	0	4
2	PGE-III	PG Elective-III	4	0	0	4
3	PGE-IV	PG Elective-IV	4	0	0	4
4	PGE-V	PG Elective-V	4	0	0	4
5	PG	PG Project Stage – I				12
6	PG	Seminar	0	0	3	2
		Total Credits				**30**

V YEAR **II SEMESTER**

S.No.	Group	Subject	L	T	P	Credits
1	PG	PG Project Stage-II				18
2	PG	Comprehensive Viva				4
		Total Credits				**22**

Core & Electives:

Group	Marketing/HR/Finance/Systems
PGC-I	Marketing Management
PGC-II	Human Resource Management
PGE-I	Sales and Distribution / Training and Development / Financial Management / Management Information System
PGC Lab	Soft Skills Lab
PGC-III core	Research Methodology & Statistical Analysis
PGC-IV core	Business Law & Regulation
PGE-II	Integrated Marketing Communications / Management of Industrial Relations / Security Analysis and Portfolio Management / Enterprise Resource Planning
PGC Lab	Statistical Analysis Lab using SPSS / Excel
PGC –V Core	Strategic Management
PGE-III	Retailing Management / Compensation & Reward Management / Strategic Investment and Financing Decisions/E-Business
PGE-IV	Services Marketing / Management of Change / International Financial Management/Cyber Security
PGE-V	International Marketing / Performance Management / Derivatives / Information System Control and Audit

- ***Students are advised to take prior approval from the Mentor of the Department of H&SS before selecting and finalizing the Electives.***

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
4	1	0	4

MATHEMATICS – I
(Common to all Branches)

Pre Requisites: NIL

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

Outcomes:
At the end of the course, the student will be able to:
- become familiar with the application of differential and integral calculus, ordinary differential equations and vector calculus to engineering problems.
- attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications.

UNIT–I: Differential calculus (12 lectures)
Rolle's Mean value Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – (all theorems without proof but with geometrical interpretations), verification of the Theorems and testing the applicability of these theorem to the given function.
Curve tracing – Equations given in Cartesian, polar and parametric forms.
Functions of several variables – Functional dependence- Jacobian- Maxima and Minima of functions of two variables with constraints and without constraints-Method of Lagrange multipliers.

UNIT–II: Improper Integrals, Multiple Integration (12 lectures)
Gamma and Beta Functions –Relation between them, their properties – evaluation of improper integrals using Gamma / Beta functions.
Multiple integrals – double and triple integrals – change of order of integration- change of variables (polar, cylindrical and spherical) . Finding the area of a region using Double integration and volume of a region in space using triple integration.

UNIT–III: Vector Calculus (12 lectures)
Vector Calculus: Scalar point function and vector point function, Gradient- Divergence- Curl and their related properties, - Laplacian operator, Line integral – Work done – Surface integrals –Volume integral. Green's Theorem, Stoke's theorem and Gauss's Divergence Theorems (Statement & their Verification). Solenoidal and irrotational vectors, Finding potential function.

UNIT–IV: First Order Ordinary Differential Equations (10 lectures)
Linear and exact differential equations
Applications of first order differential equations – Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories and electrical circuits

UNIT-V: Higher Order Ordinary Differential Equations (10 lectures)
Linear, homogeneous and non- homogeneous differential equations of second and higher order with constant coefficients. Non-homogeneous term of the type e^{ax}, Sin ax, Cos ax, and x^n, $e^{ax}V(x)$, x^n V(x). Method of variation of parameters. Applications: Bending of beams, Electrical circuits and simple harmonic motion.

Text books:

1) HIGHER ENGINEERING MATHEMATICS BY B S GREWAL, KHANNA PUBLICATIONS.
2) ENGINEERING MATHEMATICS BY ERWIN KREYSZIG, WIELY PUBLICATIONS.
3) VECTER ANALYSIS BY GHOSG & MAITY, NEW CENTRAL BOOK AGENCY.

References:

1) ENGINEERING MATHEMATICS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.
2) ADVANCED ENGINEERING MATHEMATICS BY PETER V O'NEIL, CENGAGE LEARNING.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
3	1	0	3

ENGINEERING PHYSICS

Prerequisites: Nil

Course Objectives:

The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses. Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his carrier. The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits. An earnest attempt is made in framing the course in this direction by blending careful presentation of fundamental concepts and methods of physics. The course begins with a detailed coverage of optics, which includes topics such as interference, diffraction, polarization of Light phenomenon. It then delves into discussion on Characterization of materials in terms of bonding, defects, Structures, X-ray diffraction, dielectric nature, Magnetic behavior, Superconducting nature, Nano size activity etc. The basic principles behind the Acoustics of good structures (Halls) are elucidated for easy understanding of complex concepts.

Outcomes:

The knowledge of Physics relevant to engineering is critical for converting ideas into technology. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements. In the present course, the students can gain knowledge not only about one of the naturally main source of life on the earth planet i.e. sun rays and their phenomenon, but also of other artificial light source behavior and their phenomenon. Similarly, by studying other chapters, the student can gain the knowledge of the relation between the micro level physical properties of the materials and their macro level behavior thereby acquires the idea of making them use effectively in real time situation or in applications of interest.

UNIT-I

1. **Interference**: Superposition of Waves, Young's double slit experiment, Coherence, Interference in Thin films by Reflection, Newton's Rings.
2. **Diffraction:** Fresnel and Fraunhofer diffractions, Fraunhofer diffraction at a single slit and Double slit, Diffraction Grating, Resolving Power of a Grating.
3. **Polarization:** Introduction to polarization, Double Refraction, Nicol Prism, Quarter and Half wave plates

UNIT-II

4. **Bonding in Solids**: Ionic Bond, Covalent Bond, Metallic Bond, Hydrogen Bond, Vander- Waal's Bond and Calculation of Cohesive Energy for Ionic Solids.
5. **Crystallography and Crystal Structures**: Space Lattice, Unit Cell, Lattice parameters, Crystal Systems, Bravais Lattices, Miller Indices, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Diamond Structure(Cubic), Structures of NaCl, ZnS, CsCl, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems

UNIT-III

6. **Defects in Crystals:** Point Defects: Vacancies, Substitutional, Interstitial, Frenkel and Schottky Defects, Estimation of Frenkel and Schottky Defects, Edge and Screw dislocations (Qualitative Treatment), Burger's Vector.
7. **X-ray Diffraction:** Basic Principles of **X**-ray Diffraction, Bragg's Law, Laue Method, Powder Method, Applications of X-ray Diffraction.

UNIT-IV

8. **Dielectric Properties:** Basic definitions: Electric dipole, Dipole moment, Permittivity, Dielectric constant, Polarizability, Electric susceptibility, Displacement vector; Electronic Polarization, Ionic Polarization (Quantitative treatment) and Orientation Polarization (Qualitative treatment),Internal Fields in Solids, Clausius - Mossotti Equation, Piezo-electricity, Pyro- electricity and Ferro – electricity,Properties of ferro-electric materials.
9. **Magnetic Properties:** Basic definitions: Magnetic dipole, Magnetic moment, Magnetic Induction, Magnetic field intensity, Permeability, relative permeability, Intensity of Magnetization, susceptibility, Relation between χ and μ_r ; Origin of Magnetic Moment-Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment,Domain Theory of Ferro magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Properties of Anti-Ferro and Ferri Magnetic Materials.
10. **Superconductivity:** Introduction of Superconductivity, Properties of Superconductors, Meissner Effect, BCS theory (Qualitative), Type-I and Type II Superconductors, Magnetic Levitation and Applications of Superconductors.

UNIT-V

11. **Acoustics of Buildings:** Basic Requirement of Acoustically Good Hall, Reverberation and Time of Reverberation, Sabine's Formula for Reverberation Time, Measurement of Absorption Coefficient of a material, Factors Effecting the Architectural Acoustics and their Remedies.
12. **Nanomaterials:** Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-Gel, Precipitation, combustion Methods; Top-Down Fabrication: Chemical Vapor Deposition, Physical Vapor Deposition, Characterization Techniques (XRD, SEM &TEM) and Applications.

Text books:

1. Principles of Physics by Halliday, Resnick, Walker, Wiley India Pvt Ltd, 9th Edition.
2. Introduction to Solid State Physics by Charles Kittel, Wiley India Pvt Ltd, 7th Edition
3. Engineering Physics by R.K.GAUR & S.L.GUPTA, Dhanpat Rai Publications.
4. Solid State Physics by A J Dekker, MACMILLAN INDIA LTD.

References:

1. Modern Engineering Physicsby Dr.K.Vijaya Kumar, Dr.S.Chandralingam, S.CHAND & COMPANY LTD
2. Applied Physics by P.K.Mittal, I K International Publishers
3. Applied Physics by P.K. Palanisamy :Scitech publishers
4. Introduction to Nanotechnology by Charles P.Poole, Jr.Frank J ownes, John Wiley & sons
5. Applied Physics for Engineers by P. Madusudana Rao, Academic Publishing Company
6. Engineering Physics by Sanjay D Jain, Girish G Sahasrbudha: University Press.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
3	1	0	3

APPLIED CHEMISTRY

Prerequisites: Nil

Course objectives:

The student is made to understand the basic concepts of chemistry. To explore the economically viable techniques developed for utilizing water resources and to provide the skills for analysis of water and materials. To inculcate the knowledge of corrosion to face thin burning issue of the Globe. The principle of the preparing and utilizing various polymers for varied applications.

Outcomes:

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

- learn the concepts of electrochemistry, batteries. The principles and procedures for making varied polymers for different applications are well understood. The skills pertaining to water treatment and analysis will be inculcated.

Unit-I: Water and its treatment

Introduction – hardness of water – causes of hardness – types of hardness : temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of potable water - Disinfection of potable water by chlorination and Ozonization. Boiler feed water and its treatment – Calgon conditioning – Phosphate conditioning - Colloidal conditioning – External treatment of water – ion-exchange processes. Desalination of water – Reverse osmosis. Numerical problems – Sewage water - COD, BOD definition and their significance. Treatment of sewage- Steps involved.

Unit-II: Electrochemistry and corrosion

Electrochemistry : Conductance and their interrelationship - Specific, equivalent and molar conductance . Ionic mobilities – Relationship between ionic conductance and ionic mobilities. Electro Chemical cells - electrode potential, standard electrode potential, types of electrodes – Standard hydrogen electrode, calomel and glass electrode. Nernst equation - electrochemical series and its applications.– Concept of concentration cell –Numerical problems.

Corrosion- Causes and effects of corrosion – theories of chemical and electrochemical corrosion - mechanism of electrochemical corrosion. Types of corrosion : Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods – Cathodic protection - sacrificial anode and impressed current cathodic methods. Surface coatings – metallic coatings – methods of application of metallic coatings – Hot dipping , cementation, electroplating of copper, electro less plating of Nickel - Organic coatings: Paints – their constituents and functions.

Unit-III: High Polymers:

Definition – Classification of polymers with examples – Types of polymerisation – Chain growth (free radical addition mechanism), step growth polymerization, Plastics, fibres and elastomers - definition and characteristics. Plastics – thermoplastic and thermosetting plastics, compounding of plastics . Fibre reinforced plastics. Preparation, properties and applications of PVC, Teflon, Bakelite, Nylon 6:6 and terylene (Dacron); Rubber – Natural rubber , its processing and vulcanization. Elastomers: Preparation, properties and applications of Styrene butadiene, butyl and thiokol rubbers. Conducting polymers – Classification with examples; mechanism of conduction in trans-polyacetylene and applications of conducting polymers. Biodegradable polymers – concept and advantages - Polylactic acid and their applications.

Unit-IV: Chemistry of Energy sources

Fuels :Classification of fuels - characteristics of a good fuel . Solid fuels: Coal – Analysis of coal by proximate and ultimate methods. Liquid fuels- Petroleum and its refining. Characteristics and uses of petrol, diesel and kerosene. Synthetic petrol- Fischer-Tropsch's process. Cracking – thermal cracking and catalytic cracking. Fluid bed catalytic cracking, Knocking - octane and cetane numbers. Gaseous fuels – Composition, properties and uses of Natural gas, LPG and CNG .

Combustion – Definition, calorific value, HCV and LCV. Calculation of air quantity required for combustion of a fuel - Numerical problems.
Alternate Energy sources :Biodiesel - trans-esterification - advantages of biodiesel, fuel cells (H_2-O_2 and Methanol –O_2 fuel cell).

Unit-V: Engineering Materials:
Cement – Types of cements- Portland cement and its composition, Setting and hardening of cement. Special Cements – White cement, Water proof cement, high-alumina cement and high early-strength cement .
Refractories – Characteristics of a good refractory, classification with examples – refractoriness and refractoriness under load - causes for the failure of refractories.
Abrasives: Characteristics – Classification and applications of Diamond and Carborandum (SIC)
Lubricants – Characteristics of a good lubricant – mechanism of lubrication – thick film, thin film and extreme pressure lubrication. Classification of lubricants with examples. Properties– viscosity, cloud point, pour point, flash point, fire point and mechanical stability (determination and their significance).

Text Books:
1. Engineering Chemistry by P.C.Jain & M.Jain ; Dhanpat Rai Publishing Company (P) Ltd., New Delhi, (15th Edition , 2005).
2. Engineering Chemistry by B.Rama Devi & Ch.Venkata Ramana Reddy ; Cengage Learning , 2012.

Reference Books:
1. A Text Book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai & Co., New Delhi.(3rd Edition, 2003).
2. Engineering Chemistry by Y. Bharathi Kumari and C. Jyotsna, VGS Booklinks, 2012.
3. Text book of Engineering Chemistry by C P Murthy, C V Agarwal and A. Naidu; B.S.Publications, 2006.
4. Engineering Chemistry by M. Thirumala Chary and E. Lakshminarayana, Sci tech. Publications Pvt. Ltd., Chennai 2012.
5. Engineering Chemistry by B.Sivasankar, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2008.
6. A Text Book of Engineering Chemistry by S.S. Dara, S.Chand Publications, (10th Edition, 2007).

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
4	1	0	4

COMPUTER PROGRAMMING & DATA STRUCTURES

Prerequisites:
There are no prerequisites for this course, except that anyone who wants to learn C should have analytical skills and logical reasoning.

Objectives:
1. This course starts from the basics of computers and program development.
2. It covers various concepts of C programming language
3. It introduces searching and sorting algorithms
4. It provides an understanding of data structures such as stacks and queues.

Outcomes:
At the end of the course, the student will be able to:
1. Develop C programs for computing and real life applications using basic elements like control statements, arrays, functions, pointers and strings; and data structures like stacks, queues and linked lists.
2. Implement searching and sorting algorithms

UNIT - I
Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development Method, Algorithms, Pseudo code, flow charts, applying the software development method.

Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output, Operators. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Bit wise operators, Statements, Simple C Programming examples.

UNIT – II
Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Simple C Programming examples.
Designing Structured Programs- Functions, basics, user defined functions, inter function communication, Scope, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion- recursive functions, Preprocessor commands, example C programs

UNIT – III
Arrays and Strings – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays, C program examples. Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion, C program examples.

Pointers – Introduction (Basic Concepts), Pointers for inter function communication, pointers to pointers, compatibility, memory allocation functions, array of pointers, programming applications, pointers to void, pointers to functions, command –line arguments.

UNIT - IV
Derived types – Structures – Declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, enumerated types, C programming examples.

Input and Output – Concept of a file, streams, standard input / output functions, formatted input / output functions, text files and binary files, file input / output operations, file status functions (error handling), C program examples.

UNIT – V

Sorting and Searching selection sort, bubble sort, insertion sort, linear and binary search methods.

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:

1. C & Data structures – P. Padmanabham, Third Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
3 Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.
4. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
5. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures,E.Balagurusamy,TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S.Chand & Co.

JNTUH COLLEGE OF ENGINEERING HYDERABAD

IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
4	1	0	4

CLASSICAL ENGINEERING MECHANICS

Pre Requisites: Nil

Objectives:
- To understand the resolving forces and moments for a given force system
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area

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

- Resolve forces and moments for a given system.
- Analyse the friction for moving bodies
- Determine centroid and second moment for a given area of a body.

UNIT-I : Introduction to Mechanics : Basic Concepts, system of Forces Coplanar Concurrent Forces -Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II : Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions - Motion of Bodies -Wedge Screw, Screw-jack and differential screw –jack

UNIT-III : Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

UNIT-IV : Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT-V : Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

TEXT BOOKS:
1. Singer's Engineering Mechanics Statics and Dynamics , K. Vijaya Kumar Reddy, J. Suresh Kumar, BS Publications, 3rd Edition(SI Units)Fifth impression 2013
2. Engg. Mechanics / Timoshenko & Young

REFERENCES:
1. Engg. Mechanics/ Irving Shames, G. Krishna Mohan Rao, Prentice Hall
2. Engg. Mechanics Umesh Regl / Tayal.
3. A text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain, Academic Publishing Company
4. Text Book in Applied Mechanics / Malhotra, Subramanian, Gahlot and Rathore / New Age.
5. Engg. Mechanics / KL Kumar / Tata McGraw Hill.
6. Engg. Mechanics / M.V. Seshagiri Rao & D Rama Durgaiah.
7. Engg. Mechanics / S.S. Bhavikati & K.G. Rajasekharappa

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IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
0	0	3	2

ENGINEERING PHYSICS LAB

LIST OF EXPERIMENTS

1. Dispersive power of the material of a prism –Spectrometer
2. Determination of wavelengths of a source-Diffraction Grating.
3. Newton's Rings-Radius of curvature of Plano convex lens.
4. Time constant of an R-C Circuit.
5. Magnetic field along the axis of current carrying coil-Stewart and Gee's method.
6. Bending Losses of Fibers & Evaluation of numerical aperture of given fiber.
7. Energy gap of material of PN- junction.
8. Torsional pendulum.
9. Determination of frequency of A.C Mains-Sonometer.
10. Diffraction grating using single slit- Laser source

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L	T	P	C
0	0	3	2

APPLIED CHEMISTRY LAB

LIST OF EXPERIMENTS

1) Estimation of ferrous iron by Permanganometry.
2) Estimation of ferric iron by Dichrometry,
3) Estimation of copper by Iodometry
4) Estimation of Fe^{2+} & Fe^{3+} by dichrometry.
5) Estimation of hardness of water by Complexometry using EDTA,
6) Estimation of copper by Complexometry using EDTA.
7) Estimation of alkalinity of water.
8) Estimation of Permanent hardness by EDTA
9) Preparation of Thikol rubber
10) Estimation of iron in cement by Colorimetry; $KMnO_4$
11) Estimation of Mn in $KMnO_4$ by Colorimetry;
12) Estimation of HCl in a given solution by pH - metry.
13) Estimation of HCl in acid mixture by conductometry.
14) Estimation of Fe^{2+} by Potentiometry.

Recommeded Books:

1. Inorganic Quantitative Analysis by A.I.Vogel, ELBS Publications (2007).
2. Laboratory Manual of Engineering Chemistry by Y.Bharathi Kumari & Jyotsna C, VGS Booklinks, Vijayawada, 2009.
3. College Practical Chemistrty by V.K.Ahulwalia., Narosa Publications Ltd., New Delhi (2007)

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IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) I Year I-Sem

L	T	P	C
0	0	3	2

COMPUTER PROGRAMMING & DATA STRUCTURES LAB

Week 1:

1. Write a C program to find the sum of individual digits of a positive integer.
2. 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.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.

Week 2:

5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 3:

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

Week 4:

11. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string in to a given main string from a given position.
    ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. 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.
14. Write a C program to count the lines, words and characters in a given text.

Week 5:

15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:
    $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$
    For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
    Print x, n, the sum
    Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal ? If so, test for them too.

Week 6:

18. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
19. Write a C program to convert a Roman numeral to its decimal equivalent.

Week 7:

20. 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.)

Week 8:

21. i) Write a C program which copies one file to another.
    ii) Write a C program to reverse the first n characters in a file.
    (Note: The file name and n are specified on the command line.)
22. i) Write a C program to display the contents of a file.
    ii) 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)

Week 9:

23. Write a C program that uses functions to perform the following operations on singly linked list.:
    i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 10:

24. Write C programs that implement stack (its operations) using
    i) Arrays ii) Pointers
25. Write C programs that implement Queue (its operations) using
    i) Arrays ii) Pointers

Week 11:

26. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
    i) Bubble sort ii) Selection sort

Week 12:

27. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
    i) Linear search ii) Binary search

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MATHEMATICS – II
(Common to all Branches)

Pre Requisites: NIL

Objectives:

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

Outcomes:

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

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

UNIT–I: Linear ODE with variable coefficients and series solutions (8 lectures)

Equations reducible to constant coefficients-Cauchy's and Legendre's differential equations. Motivation for series solutions, Ordinary point and Regular singular point of a differential equation, Transformation of non-zero singular point to zero singular point. Series solutions to differential equations around zero, Frobenius Method about zero.

Unit-II: Special Functions (8 lectures)

Bessel's Differential equation, Bessel functions properties: – Recurrence relations, Orthogonality, Generating function, Trigonometric expansions involving Bessel functions.

UNIT–III: Laplace Transform (8 lectures)

Definition of Integral transform. Domain of the function and Kernel for the Laplace transforms, Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions when they are multiplied or divided by "t". Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem – Dirac's delta function, Periodic function – Inverse Laplace transform by Partial fractions(Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by "s", Inverse Laplace Transforms of derivatives and integrals of functions, Convolution theorem-solving differential equations by Laplace transforms

UNIT – IV: Fourier series and Fourier Transforms (8 lectures)

Definition of periodic function. Fourier expansion of periodic functions in a given interval of length, 2π, Determination of Fourier coefficients – Fourier series of even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Fourier integral theorem – Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT-V: Partial Differential Equations (10 lectures)

Introduction and Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and non-linear equations (Charpit's method).

Method of separation of variables for second order equations. Applications of Partial differential equations- one dimensional wave equation., Heat equation.

Text books:

1) HIGHER ENGINEERING MATHEMATICS BY B S GREWAL, KHANNA PUBLICATIONS.
2) ENGINEERING MATHEMATICS BY ERWIN KREYSZIG, WIELY PUBLICATIONS

References:

1) ENGINEERING MATHEMATICS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.
2) ADVANCED ENGINEERING MATHEMATICS BY PETER V O'NEIL, CENGAGE LEARNING

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FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Prerequisites: NIL

Objectives:
- To introduce the concept of electrical circuits and its components.
- To introduce the characteristics of various electronic devices.
- To impart the knowledge of various configurations, characteristics and applications of electrical & electronic components.

Outcomes:
At the end of the course, the student will be able to:
- To analyze and solve electrical circuits using network laws and theorems.
- To design & analyse various circuits using electronic components viz. diodes, transistors & other special purpose devices.

UNIT- I ELECTRICAL and SINGLE PHASE AC CIRCUITS
Electrical Circuits - R-L-C Parameters, Voltage and Current Independent and Dependent Sources, Source Transformation – V–I relationship for Passive elements, Kirchoff's Laws, Network reduction techniques – series, parallel, series parallel, star–to-delta, delta-to-star transformation,
Single Phase AC Circuits - R.M.S. and Average values, Form Factor, steady state analysis of series, Parallel and Series parallel Combinations of R, L and C with Sinusoidal excitation, concept of reactance, Impedance, Susceptance and Admittance – phase and phase difference, Concept of Power Factor, j-notation.

UNIT- II RESONANCE and NETWORK THEOREMS
Resonance – Series resonance and Parallel resonance circuits, concept of bandwidth and Q factor, Locus Diagrams for RL, RC and RLC Combinations for Various Parameters.
Network Theorems - Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity theorems for DC and AC excitations.

UNIT- III P-N JUNCTION DIODE & DIODE CIRCUITS
P-N Junction Diode - Diode equation, Energy Band diagram, Volt-Ampere characteristic, Temperature dependence, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.
Rectifiers and Filters - The P-N junction as a rectifier - A Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT- IV BIPOLAR JUNCTION TRANSISTOR
Bipolar Junction Transistor (BJT) - Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations.

Transistor Configurations - BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, Comparison of CE, CB and CC configurations.

UNIT- V JUNCTION FIELD EFFECT TRANSISTOR & SPECIAL PURPOSE DEVICES:
Junction Field Effect Transistor - Construction, Principle of Operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and JFET.

Special Purpose Devices - Breakdown Mechanisms in Semi Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of Tunnel Diode (With the help of Energy band diagram) and Varactor Diode, Principle of Operation of SCR.

TEXT BOOKS:

1. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J.Millman and C.C.Halkias, Satyabratajit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 6th edition.

REFERENCES:

1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education.
2. Electronic Devices and Circuits - K. Lal Kishore, B.S. Publications, 2nd Edition, 2005.
3. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal –Wiley India Pvt. Ltd. 1/e 2009.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches)- 2nd edition by Raymond A. DeCarlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N.C.Jagan & C.Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.

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ENGLISH

1. INTRODUCTION:

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competencies of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure. Hence, it is suggested that they read the topics selected for discussion on their own in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material, etc. *However, the stress in this syllabus is on skill development, fostering ideas and practice of language skills.*

2. OBJECTIVES:

a. To improve the language proficiency of the students in English with emphasis on LSRW skills.
b. To equip the students to study academic subjects more effectively using the theoretical and practical components of the English syllabus.
c. To develop the study skills and communication skills in formal and informal situations.

LEARNING OUTCOMES:

1. Use of English Language - written and spoken.
2. Enrichment of comprehension and fluency
3. Gaining confidence in using language in verbal situations.

SYLLABUS:

Listening Skills:

Objectives

1. To enable students develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them, to distinguish between them, to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students express themselves fluently and appropriately in social and professional contexts.
   - Oral practice
   - Describing objects/situations/people
   - Role play – Individual/Group activities (Using exercises from the five units of the prescribed text: ***Skills Annexe–Functional English for Success)***
   - Just A Minute (JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences, etc.
   - Skimming the text
   - Understanding the gist of an argument
   - Identifying the topic sentence
   - Scanning
   - Inferring lexical and contextual meaning
   - Understanding discourse features
   - Recognizing coherence/sequencing of sentences

NOTE: *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.*

Writing Skills:

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.
   - Writing sentences
   - Use of appropriate vocabulary
   - Paragraph writing
   - Coherence and cohesiveness
   - Narration / description
   - Note Making
   - Formal and informal letter writing
   - Describing graphs using expressions of comparison

TEXTBOOKS PRESCRIBED:

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Five Units**, are prescribed:

For Detailed study: **First Textbook:** ***"Skills Annexe -Functional English for Success***", Published by Orient Black Swan, Hyderabad

For Non-detailed study

Second Textbook ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad.

- The course content and study material is divided into **Five Units.**

Unit –I

1. Chapter entitled '***Wit and Humour***' from '**Skills Annexe' -Functional English for Success**, Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Mokshagundam Visvesvaraya'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad.

   L - Listening for Sounds, Stress and Intonation
   S - Greeting and Taking Leave, Introducing Oneself and Others (Formal and Informal Situations)
   R - Reading for Subject/ Theme- ***The Palm Islands*** from Epitome of Wisdom is for **Reading Comprehension**
   W - Writing Paragraphs
   G - Types of Nouns and Pronouns
   V - Homonyms, Homophones & Homographs

Unit –II

1. Chapter entitled "***Cyber Age"*** from "***Skills Annexe -Functional English for Success***" Published by Orient Black Swan, Hyderabad.
2. **Report Writing (First & Second Textbooks)**
   L - Listening for themes and facts
   S - Apologizing, interrupting, requesting and making polite conversation
   R- Reading for theme and gist- The 1 Thing Every Business Executive Must Understand about Social Media by Dave Kerpen from Skills Annexe is for **Reading Comprehension**
   W - Describing people, places, objects, events
   G - Verb forms
   V - Noun, Verb, Adjective and Adverb

Unit –III

1. Chapter entitled **'*Risk Management'*** from **"*Skills Annexe -Functional English for Success*"** Published by Orient Black Swan, Hyderabad
2. Chapter entitled **'*Leela's Friend'*** by R.K. Narayan from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad
   L - Listening for main points and sub-points for note taking
   S - Giving instructions and directions; Speaking of hypothetical situations
   R - Reading for details- *Sivakasi: Who to Blame for the Frequent Fire Accidents in India's Largest Fireworks Industry Hub?* by Amrutha Gayathri from Skills Annexe & *Forensic Science* from Epitome of Wisdom are for **Reading Comprehension**
   W - Note-making, Information transfer, Punctuation
   G - Present tense
   V - Synonyms and Antonyms

Unit –IV

1. **Letter Writing – Writing formal letters, letter of application along with curriculum vitae (First & Second Textbooks)**
2. Chapter entitled ***'The Last Leaf'*** from ***"Epitome of Wisdom",*** Published by Maruthi Publications, Hyderabad
   L - Listening for specific details and information
   S - Narrating, expressing opinions and telephone interactions
   R - Reading for specific details and information- *What I Cherish Most* by V. S. Srinivasa Sastri from Skills Annexe & *Choose How to Start Your Day* from Epitome of Wisdom are for **Reading Comprehension**
   W - Writing e-mails
   G - Past and Future tenses
   V - Vocabulary - Idioms and Phrasal verbs

Unit –V

1. Chapter entitled '***Sports and Health'*** from ***"Skills Annexe -Functional English for Success***" Published by Orient Black Swan, Hyderabad
2. Chapter entitled ***'The Convocation Speech'*** by N.R. Narayanmurthy' from ***"Epitome of Wisdom"***, Published by Maruthi Publications, Hyderabad
   L - Critical Listening and Listening for speaker's tone/ attitude
   S - Group discussion and Making presentations
   R - Critical reading, reading for reference - *Benefits of Physical Activity* from Skills Annexe & *What is meant by Entrepreneurship?* from Epitome of Wisdom are for **Reading Comprehension**
   W - Project proposals; Project Reports and Research Papers
   G - Adjectives, Prepositions and Concord
   V - Collocations and Technical vocabulary, Using words appropriately
   - **Exercises from the texts not prescribed shall be used for classroom tasks.**

REFERENCES:

1. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw –Hill.
2. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
3. Contemporary English Grammar Structures and Composition by David Green, MacMillan Publishers, New Delhi. 2010.
4. Technical Communication, Meenakshi Raman, Oxford University Press
5. Practical English Usage, Michael Swan, Oxford University Press
6. Innovate with English: A Course in English for Engineering Students, edited by T Samson, Foundation Books.
7. English Grammar Practice, Raj N Bakshi, Orient Longman.
8. Technical Communication by Daniel Riordan. 2011. Cengage Publications. New Delhi.
9. Handbook of English Grammar& Usage, Mark Lester and Larry Beason, Tata Mc Graw –Hill.
10. Spoken English, R.K. Bansal & JB Harrison, Orient Longman.
11. Grammar Games, Renuvolcuri Mario, Cambridge University Press.
12. Everyday Dialogues in English, Robert J. Dixson, Prentice Hall India Pvt Ltd.,
13. ABC of Common Errors Nigel D Turton, Mac Millan Publishers.
14. Basic Vocabulary Edgar Thorpe & Showick Thorpe, Pearson Education
15. An Interactive Grammar of Modern English, Shivendra K. Verma and Hemlatha Nagarajan , Frank Bros & CO

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ENGINEERING GRAPHICS

Pre-requisites: Nil

Course objectives:
- To provide basic concepts in engineering drawing.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

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

- Preparing working drawings to communicate the ideas and information.
- Read, understand and interpret engineering drawings.

UNIT – I
INTRODUCTION TO ENGINEERING DRAWING :
Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid,
Involute. Scales – Plain, Diagonal and Vernier Scales.

UNIT- II
ORTHOGRAPHIC PROJECTIONS:
Principles of Orthographic Projections – Conventions – Projections of Points and Lines
Projections of Plane regular geometric figures.—Auxiliary Planes.

UNIT – III
Projections of Regular Solids – Auxiliary Views.

UNIT – IV
Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere.
Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT – V
ISOMETRIC PROJECTIONS :
Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.
Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions
Auto CAD: Basic principles only

TEXT BOOKS:
1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing and Graphics Rane and Shah/ Pearson Edu.

REFERENCE BOOKS:
1. A Text Book of Engineering Drawing / Dhawan R K / S. Chand
2. Engineering Graphics With Auto CAD / James D Bethune / Pearson Edu.
3. Engineering Graphics / K R Mohan / Dhanpat Rai.
4. Text book on Engineering Drawing / KL Narayana/ P Kannaih/ Scitech

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ENVIRONMENTAL SCIENCE

Prerequisites : NIL

Objectives:

- Creating the awareness about environmental problems among students.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating students to participate in environment protection and environment improvement.

Outcomes:

At the end of the course, it is expected that students will be able to:

- Identify and analyze environmental problems as well as the risks associated with these problems
- Understand what it is to be a steward in the environment
- Studying how to live their lives in a more sustainable manner

UNIT- I

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:

Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - II

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

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

UNIT - III

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

UNIT - IV

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

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

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

UNIT - V

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

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

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

TEXT BOOK:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.,UniversitiesPress
2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:

1. Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.

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COMPUTATIONAL MATHEMATICS
(Common to all Branches)

Pre Requisites: NIL

Objectives:
- This course aims at providing the student with the concepts of matrices, numerical techniques and curve fitting.

Outcomes:
At the end of the course, the student will be able to:
- analyze engineering problems using the concepts of Matrices and Numerical Methods.

UNIT-I: Matrices and Linear Transformations (8 lectures)
Real matrices – Symmetric, skew – symmetric, orthogonal. Complex matrices: Hermitian, Skew-Hermitian and Unitary Matrices. Idempotent matrix, Finding rank of a matrix by reducing to Echelon and Normal forms. Consistency of system of linear equations (homogeneous and non- homogeneous) using the rank of a matrix.
Cayley-Hamilton Theorem (without Proof) – Verification. Finding inverse of a matrix and powers of a matrix by Cayley-Hamilton theorem, Linear dependence and Independence of Vectors. Linear Transformation – Orthogonal Transformation. Eigen values and Eigen vectors of a matrix. Properties of Eigen values and Eigen vectors of matrices. Diagonolization of matrix – Quadratic forms upto three variables- Reduction of quadratic form to canonical form, Rank – Positive definite, negative definite – semi definite – index – signature of quadratic form.

UNIT–II: Interpolation and Curve fitting (5 lectures)
Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols- Difference Equations – Differences of a polynomial-Newton's formulae for interpolation – Interpolation with unevenly spaced points-Lagrange's Interpolation formula. **Curve fitting**: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

UNIT–III: Numerical techniques (5 lectures)
Solution of Algebraic and Transcendental Equations and Linear system of equations.
Introduction – Graphical interpretation of solution of equations .The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method .
Solving system of non-homogeneous equations by L-U Decomposition method(Crout's Method)Jacobi's and Gauss-Seidel Iteration method

UNIT- IV: Numerical Differentiation, Integration: (5 lectures)
Numerical differentiation, Numerical integration – Trapezoidal rule, Simpson's $1/3^{rd}$ and 3/8 Rule , Generalized Quadrature.

UNIT – V: Numerical solutions of First order differential equations (5 lectures)
Numerical solution of Ordinary Differential equations: Solution by Taylor's series method –Picard's Method of successive Approximation- single step methods-Euler's Method-Euler's modified method, Runge-Kutta Methods.

Text Books:
1) INTRODUCTORY METHODS OF NUMERICAL ANALYSIS BY SS SASTRY
2) NUMERICAL AND STATISTICAL METHODS WITH PROGRAMMING IN C BY SUJATHA SINHA AND SUBHABRADA DINDA, SCITEC PUBLISHERS.
3) NUMERICAL METHODS, PRINCIPLES, ANALYSIS AND ALGORITHMS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.

References:

1) ADVANCED ENGINEERING MATHEMATICS BY ALAN JEFFERY
2) APPLIED NUMERICAL METHODS USING MATLAB BY RAO.V.DUKKIPATI, NEW AGE PUBLISHERS
3) NUMERICAL METHODS IN SCIENCE AND ENGINEERING –APRACTICAL APPROACH BY S.RAJASEKHARAN, S.CHAND PUBLICATIONS

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ENGINEERING WORKSHOP

Pre-requisites: **Practical skill**

Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
- To understanding the computer hardware and practice the Assembly of computer parts.
- To practice the process of Installation of operating system windows.

Outcomes:

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

- Better understanding the process of assembly of computer parts and installation of different software's.
- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.

I. TRADES FOR EXERCISES :
(Any **six** trades from the following with minimum of **two** exercises in each trade)

1. Carpentry
2. Fitting
3. Tin-Smithy
4. Black Smithy
5. House-wiring
6. Foundry
7. Plumbing

II. Trades for Demonstration & Exposure

1. Demonstration of power tools & wiring
2. Welding
3. Machine Shop

III. **IT Workshop I:** Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, simple diagnostic exercises.

IT Workshop II: Installation of operating system windows and linux simple diagnostic exercises.

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ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

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

Objectives

- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning
- To sensitise the students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency in spoken English and neutralize mother tongue influence
- To train students to use language appropriately for interviews, group discussion and public speaking

Learning Outcomes

- Better Understanding of nuances of language through audio- visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking with clarity and confidence thereby enhancing employability skills of the students

SYLLABUS

English Language Communication Skills Lab shall have two parts:

a. **Computer Assisted Language Learning (CALL) Lab**
b. **Interactive Communication Skills (ICS) Lab**

The following course content is prescribed for the **English Language Communication Skills Lab**

Exercise – I
CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session
Articles, Prepositions, Word formation- Prefixes & Suffixes, Synonyms & Antonyms

Exercise – II
CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.
ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing Others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette.
Concord (Subject in agreement with verb) and Words often misspelt- confused/misused

Exercise - III
CALL Lab: Minimal Pairs- Word accent and Stress Shifts- Listening Comprehension.
ICS Lab: Descriptions- Narrations- Giving Directions and guidelines.
Sequence of Tenses, Question Tags and One word substitutes.

Exercise – IV
CALL Lab: Intonation and Common errors in Pronunciation.
ICS Lab: Extempore- Public Speaking
Active and Passive Voice, –Common Errors in English, Idioms and Phrases

Exercise – V
CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice

ICS Lab: Information Transfer- Oral Presentation Skills
Reading Comprehension and Job Application with Resume preparation.

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
   The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.
   System Requirement (Hardware component):
   Computer network with Lan with minimum 60 multimedia systems with the following specifications:
   i) P – IV Processor
      a) Speed – 2.8 GHZ
      b) RAM – 512 MB Minimum
      c) Hard Disk – 80 GB
   ii) Headphones of High quality

2. **Interactive Communication Skills (ICS) Lab :**
   The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.

Suggested Software:

- **Cambridge Advanced Learners' English Dictionary with CD.**
- **Grammar Made Easy by Darling Kindersley**
- **Punctuation Made Easy by Darling Kindersley**
- Clarity Pronunciation Power – Part I
- Clarity Pronunciation Power – part II
- **Oxford Advanced Learner's Compass, 8th Edition**
- ***DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.***
- Lingua TOEFL CBT Insider, by Dreamtech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge**
- **English Pronunciation in Use** (Elementary, Intermediate, Advanced) Cambridge University Press
- Raman, M & Sharma, S. 2011. Technical Communication, OUP
- Sanjay Kumar & Pushp Lata. 2011. Communication Skills, OUP

SUGGESTED READING:

1. Rama Krishna Rao, A. *et al. English Language Communication Skills – A Reader cum Lab Manual Course Content and Practice.* Chennai: Anuradha Publishers
2. Suresh Kumar, E. & Sreehari, P. 2009. *A Handbook for English Language Laboratories.* New Delhi: Foundation
3. *Speaking English Effectively* 2nd Edition by Krishna Mohan and N. P. Singh, 2011. Macmillan Publishers India Ltd. Delhi.
4. Sasi Kumar, V & Dhamija, P.V. *How to Prepare for Group Discussion and Interviews.* Tata McGraw Hill
5. Spoken English: A Manual of Speech and Phonetics by R. K. Bansal & J. B. Harrison. 2013. Orient Blackswan. Hyderabad.
6. *English Pronunciation in Use. (Elementary, Intermediate & Advance).* Cambridge: CUP
7. Chris Redston, Gillie Cunningham, Jan Bell. *Face to Face* (2nd Edition). Cambridge University Press
8. Nambiar, K.C. 2011. *Speaking Accurately. A Course in International Communication.* New Delhi : Foundation
9. Soundararaj, Francis. 2012. *Basics of Communication in English. New Delhi: Macmillan*
10. A textbook of English Phonetics for Indian Students by T. Balasubramanian (Macmillan)

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Examination:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 30 sessional marks and 70 semester-end Examination marks. Of the 30 marks, 20 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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COMPUTATIONAL MATHEMATICS LAB
(Common to all Branches)

UNIT- I: Interpolation
Programming Tasks:

A) Write a program to determine y for a given x, if two arrays of x and y of same size are given (using Newton's interpolation both forward and backward)
B) Write a program to determine y for a given x, if two arrays of x and y of same size are given.(using Lagrange 's interpolation)
C) Write a program to determine y for a given x, if two arrays of x and y of same size are given.(using Gauss interpolation)
(Selection criteria of the interpolation formula are important.)

UNIT- 1I: Curve fitting
Programming Tasks:

A) Write a program to find a line of best fit from the given two arrays of x and y of same size.
B) Write a program to find a curve of the form $y = Ae^{Bx}$ from the given two arrays of x and y of same size.
C) Write a program to find a curve of the form $y = Ax^B$ from the given two arrays of x and y of same size.
D) Write a program to find a curve of the form $y = Ax^2 + Bx + C$ from the given two arrays of x and y of same size.

UNIT- 1II: Solution of Algebraic and Transcendental Equations
Programming Tasks:

A) Write a program to find the root of a given equation using bisection method.
(Write this program such that the initial values given to the system are not usable, then the system should ask us to give new set of initial values).
B) Write a program to find the root of a given equation using method of false position(regula false position).
C) Write a program to find the root of a given equation using iteration method.
D) Write a program to find the root of a given equation using Newton Rophson method.

UNIT- IV: Linear system of equations
Programming Tasks:

A) Write a program to find the solution of given system of linear equations using L- U decomposition method.
B) Write a program to find the solution of given system of linear equations using jacobi's method.
C) Write a program to find the solution of given system of equations using Gauss sidel iteration method.
D) Write a program to find the solution of given system of equations using Gauss Jordan elimination method.

UNIT-V:Numerical Differentiation, Integration and Numerical solutions of First order differential equations
Programming Tasks:

A) Write a program to evaluate definite integral using trapezoidal rule, Simpson's 1/3rd rule and 3/8th rule.
B) Write a program to solve a given differential equation using Taylor's series.
C) Write a program to solve a given differential equation Euler's and modified Eulers method.
D) Write a program to solve a given differential equation using Ruge-Kutta method.

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MATHEMATICS – III

Pre Requisites: No Pre Requisites, Foundation Course.

Objectives:
To enable the students to understand the concepts of probability distributions, statistical Inferences, and testing of hypothesis.To enable the students to understand the key concepts of Complex functions and the calculus of complex functions.

Outcomes:
The student achieves the knowledge to testing the hypothesis and form the probability distributions to make inferences. The students can study some problems of engineering using the concepts of residue theorem, Laurent series of functions of complex variables.

UNIT-I: Single Random variables and probability distributions. (12 lectures)
Random variables – Discrete and continuous. Probability distributions, mass function/ density function of a probability distribution . Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution.
Binomial , Poisson & normal distributions and their properties . Moment generating functions of the above three distributions. and hence finding the mean and variance.

UNIT-II: Multiple Random variables, Correlation & Regression (10 lectures)
Covariance of two random variables, Correlation -Coefficient of correlation, The rank correlation. Regression- Regression Coefficient, The lines of regression.

UNIT-III: Sampling Distributions and Testing of Hypothesis (10 lectures)
Sampling: Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and varience, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of varience.
Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, Level of significance. One sided test, Two sided test,

Large sample tests:
1) Test of Equality of means of two samples equality of sample mean and population mean (cases of known varience & unknown varience, equal and unequal variances)
2) Tests of significance of difference between sample S.D and population S.D.
3) Tests of significance difference between sample proportion and population proportion & difference between two sample proportions.

Small sample tests:
1) Student t-distribution, its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples
2) Chi-square distribution , it's properties, Chi-square test of goodness of fit .

UNIT-IV: Functions of Complex Variables (12 lectures)
Complex functions and its representation on Argand plane, Concepts of limit Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions – Milne – Thompson method.
Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.
Radius of convergence– Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point–Isolated singular point– pole of order m– essential singularity.

UNIT – V: Contour Integration (12 lectures)
Residue – Evaluation of residue by formula and by Laurent series – Residue theorem.
Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

Conformal mapping.

Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; inversion and reflection, Transformations like e^z, log z, z^2, and Bilinear transformation. Properties of Bilinear transformation, determination of bilinear transformation when mappings of 3 points are given .

Text Books:

1) FUNDAMENTALS OF MATHEMATICAL STATISTICS BY S C GUPTA AND V.K.KAPOOR
2) PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS BY SHELDON M.ROSS,ACADEMIC PRESS
3) HIGHER ENGINEERING MATHEMATICS BY B S GREWAL.
4) ADVANCED ENGINEERING MATHEMATICS BY PETER V O'NEIL, CENGAGE LEARNING
5) ENGINEERING MATHEMATICS BY ERWIN KREYSZIG,10TH EDITION WIELY PUBLICATIONS

References:

1) ENGINEERING MATHEMATICS BY SRIMANTAPAL & SUBODH C. BHUNIA, OXFORD UNIVERSITY PRESS.
2) ADVANCED ENGINEERING MATHEMATICS BY PETER V O'NEIL, CENGAGE LEARNING.
3) PROBABILITY AND STATISTICS FOR ENGINEERING AND THE SCIENCEC BY JAY L.DEVORE.

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METALLURGY AND MATERIAL SCIENCE

Prerequisites:
Basic idea of bonding nature in solids and different properties of elements

Objectives:
Understand the crystal structure and classification of materials and determining mechanical properties and their suitability for applications. Classify cast irons and study their applications. Interpret the phase diagrams of materials. Select suitable heat-treatment process to achieve desired properties of metals and alloys. Understand the ceramics and composite materials and their properties.

Course outcomes:
The student an able to understand basic idea of the the different material properties and heat treatment process of ferrous and non ferrous alloys with respect to phase diagrams.

UNIT – I
Structure of Metals : Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.
Constitution of Alloys : Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT -II
Equilibrium of Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe_3C.

UNIT -III
Cast Irons and Steels : Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plan carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT – IV
Heat treatment of Alloys : Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering , Hardenability surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.
Non-ferrous Metals and Alloys : Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT – V
Ceramic materials : Crystalline ceramics, glasses, cermaets, abrasive materials, nonomaterials – definition, properties and applications of the above.
Composite materials : Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.

TEXT BOOKS :
1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Material science & Metallurgy / Kodgire

REFERENCE BOOKS :
1. Science of Engineering Materials / Agarwal
2. Materials Science / Vijendra Singh
3. Elements of Material science / V. Rahghavan
4. An introduction to material science / W.g.vinas & HL Mancini
5. Material science & material / C.D.Yesudian & harris Samuel
6. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.

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MECHANICS OF SOLIDS

Pre-requisites: Basics of Engineering Mechanics

Course Outcomes:
Understand simple stress and strains of problems. Determine the resistance and deformation in member's subjected to axial, flexural and torsional loads. Evaluate the forces in pin joint – plane frames. Determine the deflections of beams using different methods. Analyze and design thin, thick cylinders and springs

UNIT-I
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
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 cantilver, simply supported and overhanging beams subjected to point loads , u.d.l, uniformly varying loads and combination of these loads – Point of contraflexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT-III
FLEXURAL STRESSES :
Theory of simple bending – Assumptions Derivation of bending equation : M/I=f/y=E/R Neutral axis – Determination bending stresses – section modules of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.
Shear Stresses : Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV
ANALYSIS OF PIN-JOINTED PLANE FRAMES : Determination of Forces in members of plane, pin-joined, perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various types of cantilever and simply – supported trusses – by method of joints, method of sections and tension coefficient methods.
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
THIN 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.
Thick Cylinders – lame's equation – cylinders subjected to inside and out side pressures – compound cylinders.

TEXT BOOKS :
1. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman
2. Strength of Materials by Jondar : Galgotia Publications

REFERENCES:
1. Strength of Materials by Bansal, Lakshmi Publications
2. Strenght of Mateirals by S. Tumoshenko
3. Strength of Materials by R.S. Khurmi; S. Chand & Co. 2005

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THERMODYNAMICS

Pre-requisite: Engineering Chemistry and Physics

Course Objective:
To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes:
At the end of the course, the student should be able to Understand and differentiate between different thermodynamic systems and processes. Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis. Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration Tables

UNIT – I
Introduction: Basic Concepts:
System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

UNIT II
PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics

UNIT – III
Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.
Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

UNIT - IV
Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables
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.

UNIT - V

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

Refrigeration Cycles:

Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS :

1. Engineering Thermodynamics / PK Nag /TMH, III Edition
2. Thermodynamics / C.P.Arora.

REFERENCE BOOKS:

1. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
2. Fundamentals of Classical Thermodynamics – G. Van Wylan & R.E. Sonntag – John Wiley Pub.
3. Thermodynamics – J.P.Holman / McGrawHill
4. Engineering Thermodynamics – Jones & Dugan
5. An introduction to Thermodynamics / YVC Rao / New Age
6. Thermodynamics & Heat Engines – Yadav – Central Book Depot, Allahabad.
7. Thermodynamics – Achutan – PHI.
8. Thermodynamics – G.C. Gupta – Pearson Publications.

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KINEMATICS OF MACHINES

Prerequisites: Basic principles of mechanics

Course Objectives:
The objective is to study the relative motion, velocity and accelerations of the various elements in a mechanism. In mechanical Engineering we come across number of mechanisms such as four bar/slider crank/double slider crank/straight line motion mechanism etc. Mechanism deals with only relative motions. Once we make a study considering for us also there it is called kinetics. The first course deals with mechanisms, their inversions straight line motion mechanisms steering mechanisms etc. Also study of cams/gears& gear trains & belts is also introduced.

Course out Comes:
The main purpose is to give an idea about the relative motions obtained in all the above type of components used in mechanical Engineering.

UNIT – I
Mechanisms : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained .
Mechanism and Machines – Mobility of Mechanisms : Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT – II
Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.
Plane motion of body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.
Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration
Analysis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III
Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism - Pantographs
Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.
Hooke's Joint: Single and double Hooke's joint –velocity ratio – application – problems.

UNIT – IV
Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.
Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V
Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding. Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of

teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing

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

TEXT BOOKS:

1. Theory of Machines /S.S.Rattan – Tata McGraw Hill Publishers.
2. Kinematics & Dynamics Of machinery/Norton/TMH

REFERENCE BOOKS:

1. Theory of Machines / Thomas Bevan/CBS
2. Theory of Machines / Sadhu Singh / Pearson.
3. Theory of Machines / Shigley / Oxford
4. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age
5. Theory of Machines by / R.K. Bansal (Lakshmi Publications).

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MACHINE DRAWING PRACTICE

Pre-requisites: Engineering Drawing

Course objectives:
To familiarize with the standard conventions for different materials and machine parts in working drawings. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.

Course Outcomes:
Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.

Question Paper Pattern:
Question paper has two parts. Part one has five questions out of which answer three (each 10 marks). Part two has one question (assembly with three views) and it is to be answered compulsorily (it carries 50 marks)

1. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
2. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
3. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
4. Title boxes, their size, location and details - common abbreviations and their liberal usage
5. Types of Drawings – working drawings for machine parts.

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

6. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
7. Keys, cottered joints and knuckle joint.
8. Rivetted joints for plates
9. Shaft coupling, spigot and socket pipe joint.
10. Journal, pivot and collar and foot step bearings.

Assembly Drawings:
Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

11. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
12. Machine tool parts: Tail stock, Tool Post, Machine Vices.
13. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block
14. Simple designs of steam stop valve, spring loaded safety valve, feed check valve and air cock.

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

TEXT BOOK :
1. Machine Drawing –K.L.Narayana/ Wiley Eastern.

REFERENCE BOOKS :
1. Machine Drawing – P.S.Gill.
2. Machine Drawing – Junnarkar N.D./ Pearson Edu.

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MECHANICS OF SOLIDS AND METALLURGY LAB

Pre-requisites: Chemistry & Physics

Course Outcomes:
At the end of the course, the student will be able to Conduct tension test on steel, aluminium, copper and brass. Perform compression tests on spring and wood.Determine elastic constants using flexural and torsion tests. Determine hardness of metals

MECHANICS OF SOLIDS LAB

List of Experiments:

1. To study the stress -strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test on U.T.M
2. To study the stress - strain characteristics of (a) Copper and (b) Aluminium by conducting tension test on Hounsfield Tensometer
3. To find the Compressive strength of wood and punching shear strength of G.I. sheet by conducting relevent tests on Housfield Tensometer
4. To find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper by conducting hardness test.
5. To determine the Modulus of rigidity by conducting Torsion test on (a) Solid shaft (b) Hollow shaft
6. To find the Modulus of rigidity of the material of a spring by conducting Compression test.
7. To determine the Young's modulus of the material by conducting deflection test on a simply supported beam.
8. To determine the Modulus of elasticity of the material by conducting deflection test on a Propped Cantilever beam.
9. To determine the Modulus of elasticity of the material by conducting deflection test on a continuous beam
10. Ductility test for steel
11. Shear test on Mild Steel rods

METALLURGY LAB

1. Preparation and study of Crystal models.
2. Study of: Specimen cutting machine Specimen mounting press Grinding and polishing equipment
3. Study of various Metallurgical Microscopes and use of leveling press
4. Metallographic preparation of ferrous specimen for Microscopic examination
5. Preparation of non-ferrous specimen for Metallographic examination
6. Preparation and Metallographic study of pure metals like Iron, Copper and Aluminium.
7. Measurement of lattice parameters of various crystal structures and calculation of packing factors and size of vacancies.
8. Identification of Microstructures of steels.
9. Estimation of Carbon content of steels using metallurgical microscope and Spark test.Thermal analysis.

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FUELS AND LUBRICANTS LAB

Prerequisite: Chemistry

Objectives: To Understand the fuel and lubricants properties

1. Determination of Flash and Fire points of Liquid fuels/Lubricants.
2. Carbon residue test: Liquid fuels.
3. Determination of Viscosity: Liquid lubricants.
4. Determination of Calorific value: Solid/Liquid/Gaseous fuels.
5. Greese penetration test.
6. Viscosity determination by Redwood & Saybolt methods.
7. Bomb/ Junkers Gas Calorimeter.

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HUMAN VALUES AND PROFESSIONAL ETHICS

Unit I

Human Values: Morals, values, ethics – integrity – work ethics –service learning –civic virtue – respect for others- living peacefully - Caring –sharing –honesty – courage –valuing time – cooperation – commitment –empathy – self-confidence –spirituality – character- Mini-Cases

Unit II

Professional Ethics: Profession- and professionalism - Two models of professionalism – Professional etiquette -Three types of Ethics or morality Responsibility in Engineering – Engineering standards –Engineering Ethics – Positive and Negative Faces. Professional Codes and Code of conduct (as given by ASME, ASCE, IEEE, IETE, Institute of Engineers as Guidelines for ethical conduct). Mini-cases.

Unit III

Professional Responsibilities: Ethical standards Vs Professional Conduct – Zero Tolerance for Culpable Mistakes – Hazards and Risks- Risk benefit analysis– congeniality, collegiality and loyalty. Respect for authority – conflicts of interest – occupational crime —Mini-Cases.

Unit IV

Professional Rights: professional rights and employee rights communicating risk and public policy – Whistle blowing - collective bargaining. Professionals /engineers as managers, advisors, experts, witnesses and consultants – moral leadership- Regulatory compliances, Monitoring and control- Mini-Cases

Unit V

Ethics in global context: Global issues in MNCs- Problems of bribery, extortion, and grease payments – Problem of nepotism, excessive gifts – paternalism – different business practices – negotiating taxes. Mini-Cases.

Mini-projects

Project 1: The student of this course should invariably attend (or watch on internet/any TV channel/youtube/social media) two speeches of 30 minutes duration each dealing with spiritual discourse and submit a report on the contents of the lecture proceedings.

Project 2: Visit any organization (including shops/ hotels or shopping malls in your region) of your choice and observe how the professionals perform the given job with a focus on professional ethics and human values.

References

1. Aryasri, *Human Values and Professional Ethics*, Maruthi Publications.
2. S B George, *Human Values and Professional Ethics,* Vikas Publishing.
3. KR Govindan & Saenthil Kumar:Professional *Ethics and Human Values*, Anuradha Publications.
4. S K Chakraborthy & D.Chakraborthy: *Human Values and Ethics*, Himalaya.
5. M. Govindarajan, S. Natarajan, & V.S. Senthilkumar: *Engineering Ethics(Includes Human Values),* HI Learning Pvt. Ltd., New Delhi – 110001

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FLUID MECHANICS & HYDRAULIC MACHINERY

Pre-requisites: None

Course Outcomes:
Understand the basic static, kinematic and dynamic principles and conservation laws to fluid flow problems in engineering applications. Design experimental procedure for physical model studies. Design the working proportions of hydraulic machines. Compute drag and lift coefficients using the theory of boundary layer flows. Analyze of free surface and pipe flows. Formulate and solve one dimensional compressible fluid flow problems. Study of different types of pumps and turbines.

UNIT I
Fluid Statics: Dimensions and Units: physical properties of fluids-specific gravity, viscosity, surface tension- vapour pressure and their influence on fluid motion-atmospheric, gauge and vaccum pressure- measurement of pressure- piezometer, U-Tube and Differential Manometers.

UNIT II
Fluid kinematics: stream line, path line and steak line and stream line, classification of flows steady & un steady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three dimensional flow.

Fluid dynamics: Surface & body forces Euler's & Bernouli's equations for flow along a stream line, moment equation and its applications on force on pipe bend. Measurement of flow: pitot tube, venture meter and orifice meter, flow nozzle.

UNIT III
Closed conduit flow: Reynold's experiment-Darcy Weisbach equation-minor losses in pipes-pipes in series and pipes in parallel-total energy line-hydraulic gradient line.
Boundary layer concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivations) boundary layer in transition, separation of boundary layers submerged objects-drag and lift .

UNIT IV
Basics and hydraulic turbine turbo machinery: Hydro dynamic force on jets on stationary and moving plate, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency , flow over radial vanes.
Classification of turbines, heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine, and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design-draft tube theory-functions and efficiency.

UNIT V
Performance of hydraulic turbines and pumps: Geometric similarity, unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbines, cavitation, surge tank, water hammer.
Centrifugal pumps: Classification, working, work done-barometric head-losses and efficiencies specific speed-performance characteristic curves, NPSH.
Reciprocating pumps: Working, discharge, slip, indicator diagrams.

TEXT BOOKS:
1. Hydraulics, Fluid mechanics and hydraulic machinery by MODI and SETH
2. Fluid mechanics and hydraulic machines by Rajput

REFERENCES:
1. Fluid mechanics and fluid power engineering by D.S.Kunar, Kotaria and sons.
2. Fluid mechanics and machinery by D. Rama Durgaiah, New age international.
3. Hydraulic machines by Banga and Sharma, Khanna publishers

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THERMAL ENGINEERING – I

Pre-requisite: Thermodynamics

Course Objective:
To apply the laws of Thermodynamics to analyse air standard cycles and to understand and evaluate the perform analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

Course Outcomes:
At the end of the course, the student should be able to Evaluate the performance of IC engines and compressors under the given operating conditions.Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles.Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance

UNIT – I
I.C. Engines:
Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT – II
Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types of SI engines.
Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating

UNIT III
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
Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.
Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

UNIT – IV
Rotary Compressor(Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.
Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.
Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

UNIT – V

REFRIGERATION : Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation – applications of air refrigeration, Vapour compression refrigeration systems – calculation of COP – effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants- Vapour absorption system – mechanical details – working principle, Use of p-h charts for calculations

Air-Conditioning: Concepts of Psychrometry – Properties of moist air – Usage of Psychrometric Chart – Calculation of moist air properties.

Types of air –conditioning systems – Requirements –– schematic layout of a typical plant.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.
3. Thermal Engineering / P.K.Nag

REFERENCE BOOKS:

1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek / Pearson /PHI
3. Thermal Engineering / Rudramoorthy - TMH
4. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot., Allahabad
5. I.C. Engines / Heywood /McGrawHIll.
6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand

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DYNAMICS OF MACHINES

Pre-requisite: Kinematics of machines

Course Outcomes:
At the end of course the student is able to design various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts.

UNIT – I
Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.
Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II
Turning Moment Diagram And Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.-.

UNIT – III
Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches.

Brakes And Dynamometers: Types of brakes: Simple block brake, band and block brake-internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – IV
Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting **–** stability – effort and power of the governors.

Balancing : Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples.
Examination of "V" and multi cylinder in-line and radial engines for primary and secondary balancing-locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V
Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

TEXT BOOKS:
1. Theory of Machines, S.S.Rattan.
2. Theory of Machines, R.S.Khurmi

REFERENCE BOOKS:
1. Theory of Machines, Shigley, Mc Graw Hill Publishers
2. Theory of Machines, Thomas Bevan, CBS Publishers
3. Theory of Machines, R.K.Bansal (Lakshmi publications)
4. Mechanism and Machine Theory, JS Rao and RV Duggipati, New Age

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PRODUCTION TECHNOLOGY

Pre-requisites: Basic Mechanical Engineering

Course Outcomes:
Understand the idea for selecting materials for patterns. Types and allowances of patterns used in casting and analyze the components of moulds. Design core, core print and gating system in metal casting processes Understand arc, gas, solid state and resistance welding processes. Develop process-maps for metal forming processes using plasticity principles.Identify the effect of process variables to manufacture defect free products.

UNIT – I
Casting : Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.
Methods of Melting - Crucible melting and cupola operation – Defects in castings;
Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.
Solidification of casting – Solidification of pure metal – Nucleation and grain growth, casting design considerations

UNIT – II
Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

UNIT – III
Inert Gas Welding _ TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT – IV
Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth.
Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements
Stamping, forming and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.
Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – V
Extrusion of Metals : Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion
Forging Processes : Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers : Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS :
1. Manufacturing Technology / P.N. Rao/TMH

REFERENCE BOOKS :
1. Production Technology / R.K. Jain
2. Metal Casting / T.V Ramana Rao / New Age
3. Principles of Metal Castings / Rosenthal.
4. Welding Process / Parmar /
5. Production Technology /Sarma P C /
6. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.

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INSTRUMENTATION AND CONTROL SYSTEMS

Prerequisite: Mathematics-I, Thermodynamics, Basic of Electrical and electronic Engineering.

Course Objectives: Understanding the basic characteristic of a typical instrument. Identifying errors and their types that would occur in a instrument. Identifying properties used for evaluating the thermal systems. The concept of transducer and Various types and their characters.

Course Outcome: To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments. Analysis of errors so as to determine correction factors for each an instrument. To understand static and dynamic characteristics of instrument and should be able to determine loading response time. For given range of displacement should be able to specify transducer, it accurate and loading time of that transducer.

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics – sources of errors, Classification and elimination of errors.

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

UNIT – II

Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Changes in Chemical Phase: Fusible Indicators and Liquid crystals.

Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge. Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, 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, Non- contact type- Stroboscope

Measurement of Acceleration and Vibration : Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV

Stress-Strain measurements : Various types of stress and strain measurements –Selection and installation of metallic strain gauges- electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter.

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems:

Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems

TEXT BOOKS:

1. Principles of Industrial Instrumentation & Control Systems, Alavala, Cengage Learning
2. Instrumentation, Measurement & Analysis, B.C.Nakra & K.K.Choudhary, TMH
3. Mechanical Measurements & Controls by D.S. Kumar

REFERENCE BOOKS:

1. Measurement Systems: Applications & design, E.O.Doebelin, TMH
2. Experimental Methods for Engineers / Holman
3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
4. Mechanical Measurements / Sirohi and Radhakrishna / New Age International.

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GENDER SENSITIZATION LAB
(Common to All Branches)
(An Activity-based Course)

Objectives of the Course:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

Unit-I: UNDERSTANDING GENDER

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

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

Unit – II: GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4) Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10) Two or Many? Struggles with Discrimination.

Unit – III: GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

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

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

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

Unit – IV: ISSUES OF VIOLENCE

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

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

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

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

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

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

Unit – V: GENDER : CO-EXISTENCE
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

Essential Reading:
All the Units in the Textbook, "*Towards a World of Equals: A Bilingual Textbook on Gender*" written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

Note:
Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

Reference Books:

1. Sen, Amartya. "More than One Million Women are Missing." New York Review of Books 37.20 (20 December 1990). Print. '*We Were Making History…' Life Stories of Women in the Telangana People's Struggle*. New Delhi: Kali for Women, 1989.
2. Tripti Lahiri. "By the Numbers: Where Indian Women Work." *Women's Studies Journal* (14 November 2012) Available online at: http:// blogs.wsj.com/ India real time/2012/11/14/by –the-numbers-where-Indan-women-work/>
3. K. Satyanarayana and Susie Tharu (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada http://harpercollins.co.in/BookDetail.asp?Book_Code=3732
4. Vimala. "Vantillu (The Kitchen)*". Women Writing in India: 600 BC to the Present. Volume II*: The 20th Century. Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press, 1995. 599-601.
5. Shatrughna, Veena et al. *Women's Work and its Impact on Child Health and Nutrition*, Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.
6. Stree Shakti Sanghatana. *"We Were Making History ….' Life Stories of Women in the Telangana People's Struggle*. New Delhi: Kali for Women, 1989.
7. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
8. Jayaprabha, A. "Chupulu (Stares)". *Women Writing in India: 600BC to the Present. Volume II*: The 20th Century Ed. Susie Tharu and K. Lalita. Delhi: Oxford University Press, 1995. 596-597.
9. Javeed, Shayan and Anupam Manuhaar. "Women and Wage Discrimination in India: A Critical Analysis." *International Journal of Humanities and Social Science Invention* 2.4(2013)
10. Gautam, Liela and Gita Ramaswamy. "A 'conversation' between a Daughter and a Mother." *Broadsheet on Contemporary Politics*. Special Issue on *Sexuality and Harassment: Gender Politics on Campus Today*. Ed. Madhumeeta Sinha and Asma Rasheed. Hyderabad: Anveshi Research Center for Women's Studies, 2014.
11. Abdulali Sohaila. "*I Fought For My Life…and Won.*"Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/
12. Jeganathan Pradeep, Partha Chatterjee (Ed). "*Community, Gender and Violence Subaltern Studies XI*". Permanent Black and Ravi Dayal Publishers, New Delhi, 2000
13. K. Kapadia. The *Violence of Development: The Politics of Identity, Gender and Social Inequalities in India.* London: Zed Books, 2002
14. S. Benhabib. *Situating the Self: Gender, Community, and Postmodernism in Contemporary Ethics,* London: Routledge, 1992
15. Virginia Woolf. *A Room of One's Own.* Oxford: Black Swan. 1992.
16. T. Banuri and M. Mahmood, *Just Development: Beyond Adjustment with a Human Face,* Karachi: Oxford University Press, 1997

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FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Pre-requisites: None

Course Outcomes:
Develop procedure for standardization of experiments. Calibrate flow discharge measuring device used in pipes channels and tanks. Determine fluid and flow properties. Characterize laminar and turbulent flows. Compute drag coefficients. Test the performance of pumps and turbines.

1. Calibration of Venturimeter & Orifice meter
2. Determination of Coefficient of discharge for a small orifice by a constant head method.
3. Determination of Coefficient of discharge for an external mouth piece by variable head method.
4. Calibration of contracted Rectangular Notch and /or Triangular Notch
5. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
6. Verification of Bernoulli's equation.
7. Performance test on single stage centrifugal pump
8. Performance test on reciprocating pump
9. Impact of jet on vanes
10. Performance and Specific speed test on Pelton wheel (or Turbo Wheel)
11. Performance and specific speed test on Francis Turbine
12. Performance and specific speed test on Kaplan Turbine
13. Performance test on multi stage pump
14. Suitability test on centrifugal pump
15. Drag and Lift Coefficients of an Aerofoil model.

Any ten of the above experiments are to be covered.

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INSTRUMENTATION & CONTROLSYSTEMS LAB

Pre-requisites: Basic principles of Instrumentation and control systems

Course Outcomes: At the end of the course, the student will be able to Characterize and calibrate measuring devices. Identify and analyze errors in measurement. Analyze measured data using regression analysis. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter.

1. Calibration of transducer for temperature measurement.
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for temperature measurement.
4. Calibration of thermocouple for temperature measurement.
5. Calibration of capacitive transducer for angular displacement.
6. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
7. Calibration of resistance temperature detector for temperature measurement.
8. Study and calibration of a rotometer for flow measurement.
9. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
10. Study and calibration of McLeod gauge for low pressure.

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PRODUCTION TECHNOLOGY LAB

Pre-requisites: Manufacturing Technology

Course Outcomes:
Understanding the properties of moulding sands and pattern making.Fabricate joints using gas welding and arc welding. Evaluate the quality of welded joints. Basic idea of press working tools and perform moulding studies on plastics.

Metals Casting Lab:

1. Moulding - 2 Exercises
2. Melting & Casting - Demonstration
3. Pattern Marking - - 1 Exercise

Welding Lab:
1) Arc Welding:
   a) Effect of polarity on welds strength & Heat affected zone
   b) Effect of current on weld strength and Heat affected zone

2) Spot Welding – Effect of current on weld strength.

3) Gas welding and brazing exercises.

Mechanical Press Working:
1) Blanking & Piercing operation & Study of simple Compound and progressive press tools.
2) Hydraulic Press: Deep Drawing and Extrusion Operations.
3) Bending and other operations.

Processing of Plastics:

1) Injection Moulding
2) Blow Moulding

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Prerequisites: Economics

Objectives:
1. To enable the student to understand the importance of the business operations like demand and supply, production function, cost analysis, markets.
2. To understand the importance of certain basic issues like forms of business organizations, capital budgeting , financial accounting and financial analysis.

Outcomes:
At the end of the course, the student will,
- Understand the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
- Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
- Develop an understanding of
- Analyse how capital budgeting decisions are carried out.
- Understanding the framework for both manual and computerised accounting process
- Know how to analyse and interpret the financial statements through ratio analysis.

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

Unit II : Production & Cost Analysis: *Production Function* – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. *Cost Analysis***:** Cost concepts. Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems) - Managerial Significance.

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

Unit IV : Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital Trading Forecast Capital Budget, Cost Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

Unit V : Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions Introduction IFRS Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). *Financial Analysis***:** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

TEXT BOOKS:
1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
2. Vijay Kumar & Appa Rao Managerial Ecoconomics & Financial Analysis, Cengage 2011.
3. J. V. Prabhakar Rao & P.V. Rao Managerial Ecoconomics & Financial Analysis, Maruthi Publishers, 2011.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2009
4. Domnick Salvatore: Managerial Economics In a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting—A Managerial Perspective, PHI, 2012.
6. S.N.Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Kasi Reddy Sraswathi, MEFA PHI Learning, 2012.
10. Shailaja & Usha : MEFA, University Press, 2012.

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DESIGN OF MACHINE MEMBERS - I

NOTE:
Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

Pre- requisites:
Engineering mechanics, mechanics of solids, manufacturing processes, metallurgy and material science.

Course objectives:
- To understand the general design procedures and principles in the design of machine elements.
- To study different materials of construction and their properties and factors determining the selection of material for various applications.
- To determine stresses under different loading conditions.
- To learn the design procedure of different fasteners, joints, shafts and couplings.

Outcomes:
- The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
- Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
- Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.

UNIT – I
INTRODUCTION: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. Tolerances and fits –BIS codes of steels.
DESIGN FOR STATIC STRENGTH: Simple stresses – Combined stresses – Torsional and Bending stresses – Impact stresses – Stress strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II
DESIGN FOR FATIGUE STRENGTH: Stress concentration – Theoretical stress Concentration factor – Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber's curve– Modified Goodman's line– Soderberg's line.

UNIT – III
RIVETED, WELDED AND BOLTED JOINTS:
Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints-eccentrically loaded riveted joints.
Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading.
Bolted joints – Design of bolts with pre-stresses – Design of joints under eccentric loading – locking devices – bolts of uniform strength.

UNIT – IV
KEYS, COTTERS AND KNUCKLE JOINTS: Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints-Knuckle joints.

UNIT – V

SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. Use of internal and external circlips, Gaskets and seals (stationary & rotary).

SHAFT COUPLINGS : Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Flange coupling (Modified).

TEXT BOOKS:

1. Machine design by Khurmi
2. Machine design/pandya & shah
3. Machine Design/ V. Bhandari/ TMH Publishers

REFERENCE BOOKS:

1. Design of Machine Elements/V.M. Faires
2. Machine design/ Schaum Series.
3. Mechanical Engineering Design/JE Shigley

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THERMAL ENGINEERING - II

Pre-requisite: Thermodynamics

Course Objective:
To apply the laws of Thermodynamics to analyse steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

Course Outcomes:
At the end of the course, the student should be able to
- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants
- Apply the laws of Thermodynamics to analyze thermodynamic cycles
- Differentiate between vapour power cycles and gas power cycles
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants
- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components

UNIT – I
Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.
Boilers – Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working 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.

UNIT – II
Steam Nozzles : Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio-Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

UNIT – III
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 - its features- Methods to reduce rotor speed-Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.
Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction –Velocity diagram – Parson's reaction turbine – Condition for maximum efficiency.

UNIT IV
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- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT – V
Jet Propulsion : Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion

Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.
Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:
1. Thermal Engineering / Rajput / Lakshmi Publications
2. Gas Turbines – V.Ganesan /TMH
3. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot
4. Thermal Engineering / Ajoy Kumar/ Narosa

REFERENCE BOOKS:
1. Gas Turbines and Propulsive Systems – P.Khajuria & S.P.Dubey - /Dhanpatrai Pub
2. Thermal Engineering – Ballaney / Khanna Pub.
3. Gas Turbines / Cohen, Rogers and Saravana Muttoo / Addison Wesley – Longman
4. Thermal Engineering – R.S. Khurmi & J.S.Gupta / S.Chand Pub.

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MACHINE TOOLS AND METROLOGY

Course Outcomes:

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

- Identify techniques to minimize the errors in measurement.
- Identify methods and devices for measurement of length, angle, gear & thread parameters, surface roughness and geometric features of parts.
- Understand working of lathe, shaper, planer, drilling, milling and grinding machines.
- Comprehend speed and feed mechanisms of machine tools.
- Estimate machining times for machining operations on machine tools.

UNIT – I

Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips.

Engine lathe – Principle of working, types of lathe, specifications.Taper turning,– Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.

UNIT – II

Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines - Principles of working – machining time calculations.

UNIT – III

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

Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations

UNIT – IV

Limits, fits and tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

Limit Gauges : Taylor's principle, Design of GO and NO GO gauges

Measurement of angles, Bevel protractor, Sine bar.

Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator.

UNIT – IV

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf.

Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.

Coordinate Measuring Machines: Types and Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology / I C Gupta./ Danpath Rai
2. Engineering Metrology / R.K. Jain / Khanna Publishers
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.
4. Production Technology by R.K. Jain and S.C. Gupta.

REFERENCE BOOKS:

1. Production Technology by H.M.T. (Hindustan Machine Tools)
2. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
3. Fundamentals of Dimensional Metrology 4e / Connie Dotson / Thomson
4. Workshop Technology – Vol.-II, B.S. Raghui Vamsi
5. Elements of Work Shop Technology – Vol. II, Hajra Choudry, Media Promoters.
6. Fundamentals of Metal Machining and Machine Tools, Geofrey Boothroyd, McGraw Hill

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THERMAL ENGINEERING LAB

Pre-Requisite: Thermodynamics & Thermal Engineering - I

Objective:
To understand the working principles of IC Engines, Compressors, Refrigeration and Air Conditioning Systems.

Tables/Codes: Refrigeration Tables, Psychrometric Chart

Syllabus

1. Flash and Fire Points (Open cup & Closed cup method)
2. Viscosity determination by Redwood & Saybolt methods
3. Bomb/ Junkers Gas Calorimeter.
4. I.C. Engines Valve / Port Timing Diagrams
5. I.C. Engines Performance Test for 4 Stroke SI engines
6. I.C. Engines Performance Test for 2 Stroke SI engines
7. I.C. Engines Morse, Retardation, Motoring Tests
8. I.C. Engines Heat Balance – CI/SI Engines
9. I.C. Engines Economical speed Test on a SI engine
10. I.C. Engines effect of A/F Ratio in a SI engine
11. Performance Test on Variable Compression Ratio Engine
12. IC engine Performance Test on a 4S CI Engine at constant speed
13. Performance Test on Reciprocating Air – Compressor Unit
14. Dis-assembly / Assembly of Engines
15. Study of Boilers

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MACHINE TOOLS AND METROLOGY LAB

Objectives:
1. To import practical exposure to the metrology equipment & Machine tools
2. To conduct experiments and understand the working of the same.

Prerequisites:
Theoritical exposure to Metrology and machine tools.

1. Step turning and taper turning on lathe machine (2 exercises)
2. Thread cutting and knurling on lathe machine (2 exercises)
3. Measurement of cutting forces on lathe
4. Machining of holes using Drilling and boring machines.
5. Gear cutting on the Milling machine
6. Grinding of Tool angles using Cylindrical / Surface Grinding
7. Measurement of lengths, heights, diameters by vernier calipers, micrometers.
8. Measurement of bores by internal micrometers and dial bore indicators.
9. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.
10. Angle and taper measurements by bevel protractor and sine bars.
11. Thread measurement by 2-wire and 3-wire methods.
12. Surface roughness measurement by Tally Surf.
13. Use of mechanical comparator

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ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

1. Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

Learning Outcomes

- Accomplishment of sound vocabulary and its proper use contextually.
- Flair in Writing and felicity in written expression.
- Enhanced job prospects.
- Effective Speaking Abilities

3. Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.

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

4. Minimum Requirement:

The Advanced Communication Skills (ACS) Laboratory shall have the following infra-structural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. Prescribed Lab Manual: A book titled ***A Course Book of Advanced Communication Skills (ACS) Lab*** published by Universities Press, Hyderabad.

6. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner's Compass**, 8th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE** (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed**
  - **Positive Thinking**
  - **Interviewing Skills**
  - **Telephone Skills**
  - **Time Management**

7. Books Recommended:

1. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai 2008.
3. **Advanced Communication Skills Laboratory Manual** by Sudha Rani, D, Pearson Education 2011.
4. **Technical Communication** by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. **Business and Professional Communication:** Keys for Workplace Excellence. Kelly M. Quintanilla & Shawn T. Wahl. Sage South Asia Edition. Sage Publications. 2011.
6. **The Basics of Communication: A Relational Perspective**. Steve Duck & David T. McMahan. Sage South Asia Edition. Sage Publications. 2012.
7. **English Vocabulary in Use** series, Cambridge University Press 2008.
8. **Management Shapers Series** by Universities Press(India)Pvt Ltd., Himayatnagar, Hyderabad 2008.
9. **Handbook for Technical Communication** by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
10. **Communication Skills** by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
11. **Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.
12. **Job Hunting** by Colm Downes, Cambridge University Press 2008.
13. **Master Public Speaking** by Anne Nicholls, JAICO Publishing House, 2006.
14. **English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hil 2009.**

15. Books on **TOEFL**/**GRE**/**GMAT**/**CAT**/ **IELTS** by Barron's/DELTA/Cambridge University Press.
16. **International English for Call Centres** by Barry Tomalin and Suhashini Thomas, Macmillan Publishers, 2009.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

***Advanced Communication Skills Lab Practicals**:*

1. The practical examinations for the ACS Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned, by inviting the External Examiner from outside. In case of the non-availability of the External Examiner, other teacher of the same department can act as the External Examiner.

Mini Project: As a part of Internal Evaluation

1. **Seminar/ Professional Presentation**
2. **A Report on the same has to be prepared and presented.**

* ***Teachers may use their discretion to choose topics relevant and suitable to the needs of students.***

* ***Not more than two students to work on each mini project.***

* ***Students may be assessed by their performance both in oral presentation and written report.***

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AUTOMOBILE ENGINEERING
PROFESSIONAL ELECTIVE- I

Pre-requisites:Thermodynamics& Thermal Engineering -1

Course Outcomes:
At the end of the course, the student will be able to:
- Understand the basic lay-out of an automobile.
- Understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
- Understand the principles of transmission, suspension, steering and braking systems.
- Understand automotive electronics. Study latest developments in automobiles.

UNIT – I
Introduction : Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarburization, Nitriding of crank shaft..

Emission from Automobiles – Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

UNIT – II
Fuel System : S.I. Engine : Fuel supply systems, Mechanical and electrical fuel pumps – carburetor – types – air filters – petrol injection.
C.I. Engines : Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, Alternative fuels for Automobiles-injection,Classification,Properties, Hybrid vehicles injection timing, testing of fuel, pumps.

UNIT – III
Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.
Ignition System : Function of an ignition system, battery ignition system, constructional features of storage battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

UNIT – IV
Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

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

UNIT – V
Steering System : Steering geometry – camber, castor, king pin rake, combined angle toe in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.
Suspension System : Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

Braking System : Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

TEXT BOOKS :

1. Automobile Engineering ,Vol. 1 & Vol. 2/ Kripal Singh
2. Automobile Engineering , Vol. 1 & Vol. 2 ,by K.M Gupta,Umesh publication

REFERENCE BOOKS :

1. A System approach to Automotive Technology by Jack Erjavec YesDee publishing pvt Ltd.
2. Automobile Engineering / William Crouse
3. Automotive Mechanics / Heitner
4. Alternative fuels of Automobiles by P.RamiReddy,Frontline publications.

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IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) III Year I-Sem

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COMPUTER GRAPHICS
PROFESSIONAL ELECTIVE- I

Objectives:
- To make students understand about fundamentals of Graphics to enable them to design animated scenes for virtual object creations.
- To make the student present the content graphically.

Outcomes:
- Will be able work in computer aided design for content presentation..
- Better analogy data with pictorial representation.

UNIT-I:
Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices
Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms.Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms

UNIT-II:
2-D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems
2-D viewing : The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm

UNIT-III:
3-D object representation : Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.3-D viewing : Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT-IV:
Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods

UNIT-V:
Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

Text Books:
1. "Computer Graphics *C version*", Donald Hearn and M.Pauline Baker, Pearson Education
2. "Computer Graphics Principles & practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.

References:
1. Computer Graphics", second Edition, Donald Hearn and M.Pauline Baker, PHI/Pearson Education.
2. Computer Graphics Second edition", Zhigand xiang, Roy Plastock, Schaum's outlines, Tata Mc-Graw hill edition.
3. rocedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
4. Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
5. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.
6. Computer Graphics, Steven Harrington, TMH

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UNCONVENTIONAL MACHINING PROCESSES
Professional Elective-I

Prerequisites: Theory of metal cutting, machine tools

Course Objectives:
1. To understand the need for the development of UnConventional machining processes.
2. To know various methods of material removal processes.
3. To know the principles and applications of Non-Conventional machining processes.

Outcomes:
1. Student will identify the problem faced in traditional metal cutting and come to an understanding of the need for the development of Unconventional machining processes.
2. Gain the knowledge of basic mechanism of various Unconventional maching processes and related equipment, variables, advantages, disadvantages, applications.
3. Given a set of physical, electrical and other parameters. Student can identify a suitable Unconventional machining process.

UNIT – I
INTRODUCTION – Need for non-convention machining methods, Classification of non -conventional machining processes, considerations in process selection, materials, general characteristics and applications of un-conventional machining processes.

UNIT – II
MECHANICAL MATERIAL REMOVAL PROCESSES: Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining – basic principles, components, process variables, advantages and disadvantages, applications.

UNIT – III
THERMAL MATERIAL REMOVAL PROCESSES: Electro Discharge Machining, Wire EDM, Laser Machining, Electron Beam Machining, Ion Beam Machining - basic principles, components, process variables, advantages and disadvantages, applications.

UNIT – IV
CHEMICAL MATERIAL REMOVAL PROCESSES: Electro Chemical Machining, Electro Chemical Grinding, Electro Chemical Honing, and Electro Chemical Deburring - basic principles, components, process variables, advantages and disadvantages, applications.

UNIT-V
MICRO MACHINING: Bulk micromachining, surface micromachining and LIGA process – General description, basic principles, components, process variables, advantages and disadvantages, applications.

TEXT BOOKS:
1. Non-Traditional Machining/ P.K.Mishra (New Age)
2. Advanced machining processes/ VK Jain/ Allied publishers

REFERENCE BOOKS:
1. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGraw Hill
2. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH
3. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.

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INDUSTRIAL ENGINEERING PRACTICES
Professional Elective-I

Prerequisites: None

Course Objective:
- Understand various practices of Industrial Engineering
- Learn the Methodology involved in work study work place design
- Learn various aspect of Man - Machine systems.

Course Outcomes:
At the end of the course the student should be able to perform time study, work measurement, work place design, job evaluation, costing and estimation of industrial processes.

Unit I:
Work Study:Introduction – definition – objectives – steps in work study – Method study – definition – objectives – steps in method study.
Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.

Unit II:
Work Place Design: Anthropometry, structural body dimensions, use of anthropometry data, work space dimensions – work space for personnel when seated – minimum requirement for restricted spaces, work surfaces, horizontal work surfaces, work surfaces when seated, standing science of seating, principles of seat design.

Unit III:
Nature of Man-Machine system – fundamental man-machine system assumptions – types of systems – database of human factors – human performance – types of human errors in system tasks – task data – empirical task data – judgemental task data
Visual Displays – process of seeing – types of visual activity – conditions that effect visual discriminations – quantitative visual display – basic design of dynamic quantitative visual displays – specific features of quantitative scales – quantitative visual display – strategy indicators – signal and warning lights.

Unit IV:
Job evaluation – methods of job evaluation – simple routing objective systems – classification methods – factor comparision method – point method – benefits of job evaluation and limitations
Merit Rating – job evaluation vs merit rating – objectives of merit rating – method for merit rating – ranking method – paid company method – checklist method.

Unit V:
Estimating and costing, Estimation: Importance – Aims – Functions – Qualities of estimator, Cost – definition – aims – standard cost – difference between estimating and costing – costing methods – elements of costs – menstruation. Estimating of material cost – machine shop – sheet metal shop – forging – welding shop.

Textbooks:
1. Motion and Time Study by Ralph M Barnes/ John Wiley & Sons
2. Industrial Engineering Management by RaviShankar/Galgotia
3. Mechanical Estimating and Costing by T.R.banga, S.C.Sharma/Khanna

Reference Books:
1. Work Study by ILO
2. Human Factors in Engineering and Design by Ernest J McCormick/ TMH
3. Production and Operation Management by Paneer Selvam/PHI
4. Industrial Engineering Handbook by Maynard.

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OPERATIONS RESEARCH
PROFESSIONAL ELECTIVE-II

Prerequisites: None

Objectives:
Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

Outcome:
Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization

UNIT – I
Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.
ALLOCATION: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II
TRANSPORTATION PROBLEM – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.
Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT – III
SEQUENCING – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines
REPLACEMENT: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV
THEORY OF GAMES: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.
INVENTORY: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V
WAITING LINES: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.
DYNAMIC PROGRAMMING:
Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

TEXT BOOK :
1. Operation Research /J.K.Sharma/MacMilan.
2. Operations Research / ACS Kumar/ Yesdee

REFERENCE BOOKS :
1. Operations Research: Methods and Problems / Maurice Saseini, Arhur Yaspan and Lawrence Friedman
2. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hillier & Libermann (TMH).

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TRIBOLOGY
PROFESSIONAL ELECTIVE-II

Pre-requisites: Fluid mechanics, Design of machine members-II

Course objectives:
- To expose the student to different types of bearings, bearing materials,
- To understand friction characteristics and power losses in journal bearings.
- To learn theory and concepts about different types of lubrication.

Outcomes:
- Understanding friction characteristics in journal bearings.
- Knowledge about different theories of lubrication to reduce friction and wear.

UNIT – I
Study of various parameters: Viscosity, flow of fluids, viscosity and its variation, absolute and kinematic viscosity, temperature 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
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
Friction and power losses in journal bearings :Calibration of friction loss, friction in concentric bearings, bearing modulus, Sommer-field number, heat balance, practical consideration of journal bearing design considerations.

UNIT – IV
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
Types of bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings.
Bearing materials : General requirements of bearing materials, types of bearing materials.

TEXT BOOK :
1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI
2. Tribology in Industry : Sushil Kumar Srivatsava, S. Chand &Co.

REFERENCE :
1. Tribology – B.C. Majumdar

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POWER PLANT ENGINEERING
PROFESSIONAL ELECTIVE- II

Objectives:

The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include

1. Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
2. A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
3. Awareness of the economic, environmental, and regulatory issues related to power generation.

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.**Steam Power Plant :** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II Internal Combustion Engine Plant:

DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.**Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparision.**Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.**Hydro Projects And Plant:** Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.**Power From Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.**Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V

Power Plant Economics And Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOK:

1. Power Plant Engineering – P.C.Sharma / S.K.Kataria Pub
2. A Course in Power Plant Engineering: / Arora and S. Domkundwar.

REFERENCES :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications
2. Power plant Engineering/ Ramalingam/ Scietech Publishers
3. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
4. An Introduction to Power Plant Technology / G.D. Rai.
5. Power plant Engg - Elanchezhian- I.K. International Pub

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FLUID POWER SYSTEMS
PROFESSIONAL ELECTIVE- II

Prequiests: Fluid Mechanics and Hydraulics Machinery

Course outcomes:
After doing this, student should be able to
- Understand the Properties of fluids, Fluids for hydraulic systems, governing laws. distribution of fluid power,
- Design and analysis of typical hydraulic circuits.
- Know accessories used in fluid power system, Filtration systems and maintenance of system.

Unit-I
Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performan curves and parameters.

Unit-II
Hydraulic actuators, types and constructional details, lever systems, control elements – direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

Unit-III
Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

Unit-IV
Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system.
Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

Unit-V
Examples of typical circuits using Displacement – Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time-dependent control, combined control, Program Control, Electro-pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metalworking, materials handling and plastics working.

Testbooks
1. John Watton: Fundamentals of Fluid Power Control. 1 st Ed. Cambridge University Press, 2009 Prerequisit
2. Blackburn,J. F.,G.Reethof, and J. L.Shearer, Fluid Power Control, New York: Technology Press of M. I.T. and Wiley.
3. Anthony Esposito,“Fluid Power with applications”,Pearson Education.
4. Ernst, W., Oil Hydraulic Power and its IndustrialApplications, New York: McGraw Hill.
5. Lewis,E.E., and H.Stern, Design of Hydraulic Control Systems, New York: McGraw Hill.
6. Morse,A. C.,Electro hydraulic Servomechanism,New York: McGraw Hill.
7. Pippenger, J.J., and R.M.Koff, Fluid Power Control systems, New York: McGraw Hill.
8. Fitch, Jr.,E.C., Fluid Power Control Systems, New York: McGraw Hill.
9. Khaimovitch,“Hydraulic and Pneumatic Control of Machine Tools”
10. John Watton,“Fluid Power Systems: modeling, simulation and microcomputer control”,Prentice Hall International.
11. Herbert E. Merritt: Hydraulic control systems, John Wiley and Sons Inc.

References:

1. Ian Mencal, Hydraulic operation and control of Machine tools • Ronald Press
2. Sterwart Hydraulic and Pneumatic power for production-Industrial Press.
3. Hasebrink J.P., and Kobler R.,"Fundamentals of Pneumatics/electropeumatics", FESTO Didactic publication No. 7301,Esslingen Germany, 1979.
4. Werner Deppert and Kurt Stoll,"Pneumatic Control-An introduction to the principles", Vogel-Verlag.
5. Blaine W.Andersen,"The analysis and Design of Pneumatic Systems", John Wiley

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DESIGN OF MACHINE MEMBERS-II

NOTE: Design Data Book is permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

Pre-requisites:
Study of engineering mechanics, design of machine members-I and theory of machines.

Course objectives:
- To gain knowledge about designing the commonly used important machine members such as bearings, engine parts, springs , belts, gears etc.
- To design the components using the data available in design data books.

Outcomes:
- Knowledge about journal bearing design using different empirical relations.
- Estimation of life of rolling element bearings and their selection for given service conditions.
- Acquaintance with design of the components as per the standard, recommended procedures which is essential in design and development of machinery in industry.

UNIT – I
Sliding contact bearings : Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings – Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design.

UNIT – II
Rolling contact bearings: Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

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

UNIT – IV
Mechanical Springs : Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – natural frequency of helical springs – Energy storage capacity – helical torsion springs – Design of co-axial springs, Design of leaf springs.
Belts & Pulleys : Transmission of power by Belt and Rope ways, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives.

UNIT – V
Gears : Spur gears& Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for wear.

TEXT BOOKS:
1. Machine Design / Pandya & Shah / Charotar
2. Machine tool design / V. Bhandari TMH

REFERENCE BOOKS :
1. Machine Design / P.Kannaiah / Scitech
2. Machine Design Volume II / S.Md.Jalaludeen
3. Design Data Book / PV Ramana Murti & M .Vidyasagar/ BS Publications

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HEAT TRANSFER

Pre-requisite: Thermodynamics

Course Objectives:
To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

Outcomes:
At the end of this course, student will be able to
- Understand the basic modes of heat transfer
- Compute one dimensional steady state heat transfer with and without heat generation
- Understand and analyze heat transfer through extended surfaces
- Understand one dimensional transient conduction heat transfer
- Understand concepts of continuity, momentum and energy equations
- Interpret and analyze forced and free convective heat transfer
- Understand the principles of boiling, condensation and radiation heat transfer
- Design of heat exchangers using LMTD and NTU methods

UNIT – I
Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.
Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions
One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation

UNIT – II
One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature
One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi infinite body.

UNIT – III
Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Π Theorem and method, application for developing semi – empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations – Integral Method as approximate method - Application of Von Karman Integral Momentum Equation for flat plate with different velocity profiles.

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

UNIT – IV
Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.
Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.
Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT V

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

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

TEXT BOOK :

1. Fundamentals of Heat Transfer –Incropera& Dewitt/John wiley
2. Fundamentals of Enggineering,Heat & Man Transfer-R.C.Sachdeva/NewAge.
3. Heat& Man Transfer-D.S.Kumar/S.K.Kataria& sons

REFERENCE BOOKS:

1. Heat Transfer – A Practical Approach – Yunus Cengel, Boles / TMH
2. Heat Transfer / HOLMAN/TMH
3. Engineering Heat and Mass Transfer – Sarit K. Das / Dhanpat Rai Pub
4. Heat and Mass Transfer – R. Yadav /CPH
5. Essential Heat Transfer - Christopher A Long / Pearson Education
6. Heat Transfer-P.K.Nag /TMH
7. Heat Transfer –Ghoshdastidar/Oxford University press.

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KINEMATICS AND DYNAMICS LABORATORY

(A Minimum of 10 experiments are to be conducted)

Prerequisites by Topics:

Prerequisites for the graduate-level course are Kinematics, Dynamics, differential equations, motion simulation, displacement, velocity, acceleration, force, torque, power, Newton's motion laws, vibration, Gyroscopic Effect, Cams, Bearings.

Objectives:

The objective of the lab is to Understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks.

Outcomes:

Upon successful completion of this lab, students should be able to:

- Understand types of motion
- Analyze forces and torques of components in linkages
- Understand static and dynamic balance
- Understand forward and inverse kinematics of open-loop mechanisms

Experiments:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
2. Determination of steady state amplitude of a forced vibratory system.
3. Static balancing using steel balls.
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
5. Field balancing of the thin rotors using vibration pickups.
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession and representation of vectors.
7. Determination of natural frequency of given structure using FFT analyzer.
8. Diagnosis of a machine using FFT analyzer.
9. Direct Kinematic analysis of a robot.
10. Inverse Kinematic analysis of a robot.
11. Trajectory planning of a robot in joint space scheme.
12. Palletizing operation using Robot programming.

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HEAT TRANSFER LAB

Pre-requisite: Thermodynamics

Course Objectives:
To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications

Outcome:
At the end of the lab sessions, the student will be able to
- Perform steady state conduction experiments to estimate thermal conductivity of different materials
- Perform transient heat conduction experiment
- Estimate heat transfer coefficients in forced convection, free convection , condensation and correlate with theoretical values
- Obtain variation of temperature along the length of the pin fin under forced and free convection
- Perform radiation experiments: Determine surface emissivity of a test plate and Stefan-Boltzmann's constant and compare with theoretical value

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

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ADVANCED THERMODYNAMICS LAB

Prerequisites: Advanced Thermodynamics

Course outcomes:
At the end of course student is able to determine the dryness fraction of steam, T-P relationship of steam, Calibration of temperature measurement apparatus.

1. Dryness fraction estimation of steam.
2. Determination of Temperature – Pressure relationship of steam using Marcet Boiler
3. Calibration of temperature measurement apparatus
4. Performance study in a cooling tower
5. Performance of a nozzle using Nozzle performance Test unit
6. Performance study of Impulse turbine
7. Performance study of Reaction Turbine
8. Simulation of fluid flow and thermal networks for design and optimization (5 experiments)

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CAD/CAM

Pre-requisites: To learn the importance and use of computer in design and manufacture

Course objectives:
To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture. To understand the need for integration of CAD and CAM

Course Outcomes:
Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces .Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components .To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT – I
Fundamentals of CAD,CAM, Automation , design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD ,Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT-II
Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions,parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III
NC Control Production Systems : Numerical control, Elements of NC system, NC part programming : Methods of NC part programming, Manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV
Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.
Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.
Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning

UNIT – V
Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.
Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.
Computer Integrated Manufacturing: CIM system, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM Principles and Applications, P.N.Rao, TMH
2. CAD/CAM Concepts and Applications, Alavala, PHI

REFERENCE BOOKS :

1. CAD/CAM /Groover M.P., Pearson education
2. CAD / CAM Theory and Practice,/ Ibrahim Zeid,TMH
3. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
4. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson
5. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

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UNCONVENTIONAL MACHINING PROCESSES
Professional Elective-III

Course Objectives:
1. To understand the need for the development of UnConventional machining processes.
2. To know various methods of material removal processes.
3. To know the principles and applications of Non-Conventional machining processes.

Prerequisites:
Theory of meteal cutting, machine tools

Out come:
1. Student will identify the problem faced in traditional metal cutting and come to an understanding of the need for the development of Unconventional machining processes.
2. Gain the knowledge of basic mechanism of various Unconventional maching processes and related equipment, variables, advantages, disadvantages, applications.
3. Given a set of physical, electrical and other parameters. Student can identify a suitable Unconventional machining process.

UNIT – I
INTRODUCTION – Need for non-convention machining methods, Classification of non -conventional machining processes, considerations in process selection, materials, general characteristics and applications of un-conventional machining processes.

UNIT – II
MECHANICAL MATERIAL REMOVAL PROCESSES: Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining – basic principles, components, process variables, advantages and disadvantages, applications.

UNIT – III
THERMAL MATERIAL REMOVAL PROCESSES: Electro Discharge Machining, Wire EDM, Laser Machining, Electron Beam Machining, Ion Beam Machining - basic principles, components, process variables, advantages and disadvantages, applications.

UNIT – IV
CHEMICAL MATERIAL REMOVAL PROCESSES: Electro Chemical Machining, Electro Chemical Grinding, Electro Chemical Honing, and Electro Chemical Deburring - basic principles, components, process variables, advantages and disadvantages, applications.

UNIT-V
MICRO MACHINING: Bulk micromachining, surface micromachining and LIGA process – General description, basic principles, components, process variables, advantages and disadvantages, applications.

TEXT BOOKS:
1. Non-Traditional Machining/ P.K.Mishra (New Age)
2. Advanced machining processes/ VK Jain/ Allied publishers

REFERENCE BOOKS :
1. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGraw Hill
2. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH
3. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.

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ADVANCED IC ENGINES
Professional Elective -III

Pre-requisites: Thermodynamics, Internal Combustion Engines

Course Objectives:
The main objectives of this course are
- Understand the cyclic process
- Gas Exchanger Process
- Charge Motion
- Combustion Analysis in S.I & C.I engines

Course Outcomes:
At the end of the course, the student will be able to, Classify combustion chambers of IC engines and understand combustion phenomena in IC engines. Understand the working of stratified charge engine, low heat rejection engine and rotary combustion engine. Analyze exhaust emissions, methods to control the pollutants and list the emission standards. Study the design and development of viable engines working with alternate fuels. Understand advanced combustion processes including HCCI, PCCI and RCCI engines.

UNIT - I: Introduction – Historical Review – Engine Types – Design and operating Parameters.
Cycle Analysis: Thermo-chemistry of Fuel – Air mixtures, properties – Ideal Models of Engine cycles – Real Engine cycles - differences and Factors responsible for – Computer Modeling.

UNIT - II: Gas Exchange Processes: Volumetric Efficiency – Flow through ports – Supercharging and Turbo charging.
Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

UNIT - III: Engine Combustion in S.I engines: Combustion and Speed – Cyclic Variations – Ignition – Abnormal combustion Fuel factors, MPFI, SI engine testing.
Combustion in CI engines: Essential Features – Types off Cycle. Pr. Data – Fuel
Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system

UNIT - IV: Pollutant Formation and Control: Nature and extent of problems – Nitrogen Oxides, Carbon monoxide, unburnt Hydrocarbon and particulate – Emissions – Measurement – Exhaust Gas Treatment, Catalytic converter, SCR, Particulate Traps, Lean, NOx, Catalysts.

UNIT - V:
Fuel supply systems for S.I. and C.I engines to use gaseous fuels like LPG, CNG and Hydrogen.
Modern Trends in IC Engines
- Lean Burning and Adiabatic concepts
- Rotary Engines.
- Modification in I.C engines to suit Bio - fuels.
- HCCI and GDI concepts

REFERENCES BOOKS:
1. I.C. Engines Fundamentals/Heywood/Mc Graw Hill
2. The I.C. Engine in theory and Practice Vol.I / Teylor / IT Prof. And Vol.II
3. I.C. Engines: Obert/Int – Text Book Co.
4. I.C. Engines: Maleev
5. Combustion Engine Processes: Lichty
6. I.C. Engines: Ferguson
7. Scavenging of Two – stroke Cycle Engines – Switzer.
8. I.C.Engines by V.Ganesan

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REFRIGERATION AND AIR CONDITIONING
Professional Elective -III

PREREQUISITES: None

COURSE OBJECTIVES: The course is intended to
- Familiarize students with the terminologies associated with refrigeration & air conditioning
- Cover the basic principles of psychometric and applied psychometrics
- Familiarize students with system analysis
- Familiarize students with load calculations and elementary duct design
- Familiarize students with refrigerants; vapor compression refrigeration and multi-stage vapor compression systems
- Understand the components of vapor compression systems and other types of cooling systems.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Understand physical and mathematical aspects of refrigeration and air- conditioning systems.
- Apply theoretical and mathematical principles to simple, complex vapour compression and vapour absorption refrigeration systems.
- Understand conventional and alternate refrigerants and their impact on environment.
- Design air-conditioning systems.

UNIT – I
VAPOUR COMPRESSION REFRIGERATION: Performance of Complete vapor compression system. **Components of Vapor Compression System:** The condensing unit – Evaporators – Expansion valve – Refrigerants – Properties – ODP & GWP - Load balancing of vapor compression Unit.
Compound Compression: Flash inter-cooling – flash chamber – Multi-evaporator & Multistage systems.

UNIT – II
PRODUCTION OF LOW TEMPERATURE: Liquefaction system; Cascade System – Applications.– Dry ice system.
Vapor absorption system – Simple and modified aqua – ammonia system – Representation on Enthalpy –Concentration diagram.
Lithium – Bromide system Three fluid system – HCOP.

UNIT – III
AIR REFRIGERATION: Applications – Air Craft Refrigeration -Simple, Bootstrap, Regenerative and Reduced ambient systems – Problems based on different systems.
Steam Jet refrigeration system: Representation on T-s and h-s diagrams – limitations and applications.
Unconventional Refrigeration system – Thermo-electric – Vortex tube & Pulse tube – working principles.

UNIT – IV
AIR –CONDITIONING: Psychometric properties and processes – Construction of Psychometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature. Summer, winter and year round air – conditioning systems.
Cooling load Estimation: Occupants, equipments, infiltration, duet heat gain fan load, Fresh air load.

UNIT – V
AIR –CONDITIONING SYSTEMS: All Fresh air , Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP,RSHF, ESHF and GSHF for different systems.

Components: Humidification and dehumidification equipment – Systems of Air cleaning – Grills and diffusers – Fans and blowers – Measurement and control of Temperature and Humidity.

REFERENCES:

1. Refrigeration & Air Conditioning /C.P. Arora/TMH
2. Basic Refrigeration & Air Conditioning – P.N. Ananthanarayanan – McGraw Hill
3. Refrigeration and Air Conditioning – Dr. S.S. Thipse - Jaico
4. Principles of Refrigeration/Dossat /Pearson
5. Refrigeration & Air Conditioning /Arora & Domkundwar/ Dhanpat Rai
6. Refrigeration and Air Conditioning /Manohar Prasad/
7. Refrigeration and Air Conditioning /Stoecker /Mc Graw Hill
8. Refrigeration and Air Conditioning /Jordan& Preister /Prentice Hall
9. Refrigeration and Air Conditioning/Dossat /Mc Graw Hill

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ADVANCED MANUFACTURING PROCESSES

Prerequisites: Production Technology

Course Objectives: The main objectives are

- Understand the surface treatment
- Various nontraditional machining processes & their mechanics
- Understand the working principle parametric analysis & other aspects of laser machining process

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

- Understand the working principle of Electron beam, laser beam and laser hybrid welding processes.
- Understand different types of composite material characteristics, types of micro & macro machining processes.
- Understand the e-manufacturing & nano materials.
- Understand the processing of Ceramics

UNIT - I:

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT - II:

Non-Traditional Machining: Introduction, need ,AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics , performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR, Surface finish, WEDM.

UNIT - III:

Laser Beam Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.
Plasma Arc Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.
Electron Beam Machining - Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.
Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.

UNIT - IV:

Processing of ceramics : Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying , sintering, Hot compaction, Area of application , finishing of ceramics.
Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT - V:

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics.
E-Manufacturing, nanotechnology, and micromachining, High speed Machining

TEXT BOOKS:

1. Manufacturing Engineering and Technology, Kalpakijian, Adisson Wesley, 1995.
2. Process and Materials of Manufacturing, R. A. Lindburg, 4th edition, PHI 1990.
3. Foundation of MEMS/ Chang Liu/Pearson, 2012.
4. Advanced Machining Processes, V.K.Jain, Allied Publications.
5. Introduction to Manufacturing Processes, John A Schey, Mc Graw Hill.

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ADVANCED METAL FORMING
(PG Elective- I)

Prerequisites: Production Technology

Objectives: the main objectives of this course are
- Understand the fundamentals of the metal forming
- Understand the Rolling process, forces involve and geometrical relationship
- Understand the forging process & forging of various shapes
- Understand the sheet metal process

Course Outcomes: At the end of the course, the student is able
- To study the basic concepts of metal forming techniques and to develop force calculation in metal forming process.
- To study the thermo mechanical regimes and its requirements of metal forming

UNIT - I:
Fundamentals of Metal Forming: Classification of forming processes, mechanisms of metal forming: slab method, Upper and lower bound analysis, Deformation energy method and finite element method temperature of metal working, hot working, cold working, friction and lubricants.

UNIT - II:
Rolling of metals: Rolling processes, forces and geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations, Problems.

UNIT - III:
Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging.problems on flow stress ,true strain and forging load.
Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

UNIT - IV:
Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes. Problems on extrusion load.
Drawing: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing.Problems on drawforce.

UNIT - V:
Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts.
Advanced Metal forming processes: HERF, Electromagnetic forming, residual stresses, in-process heat treatment and computer applications in metal forming.problems on Blanking force,Blank diagram in Cup Diagram, Maximum considering shear.

Text Books:
1. Mechanical Metallurgy / G.E. Dieter / Tata McGraw Hill, 1998. III Edition
2. Principles of Metal Working / Sunder Kumar

References:
1. Principles of Metal Working processes / G.W. Rowe
2. ASM Metal Forming Hand book.

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VIBRATION ANALYSIS AND CONDITION MONITORING
(PG Elective- I)

Prerequisites: Dynamics of Machinery

Course Objectives:
The main objectives of this course are
- study the causes & effects of vibration in mechanical systems
- Identification of discrete & continuing systems
- Development of models for physical system
- Understand the role of damping, stiffness & inertia in machine tools
- Design and analysis of machine support structures, Vibration Isolators, Vibration Absorbers.

Course Outcomes:
At the end of the course, the student will be able to
- Exemplify and summarise the causes and effects of vibration in mechanical systems and identify discrete and continuous systems.
- Model the physical systems in to schematic models and formulate the governing equations of motion
- Infer the role of damping and stiffness and inertia in machine tools
- Analyze the Rotating/reciprocating systems and abele to compute the critical speeds.
- Analyze and design machine supporting structures, Vibration Isolators, Vibration Absorbers.
- Summarize the concept of mode, node and frequencies and calculate the free and forced vibration responses of multi degree of freedom systems through model Analysis.

UNIT-I FUNDAMENTALS OF VIBRATION: Basic concepts of Vibration, Vibration, Elementary parts of vibrating systems, Degree of freedom. Free Vibration of Single Degree of Freedom Systems: Introduction, Free Vibration of an Undamped Translational System, Equation of Motion using Newton's second law of motion, Equation of motion using other methods, Equation of motion of a spring, mass system in vertical position, solution, Harmonic Motion Free Vibration of an Undamped Torsional System- Equation of motion. Free Vibration with Viscous Damping- Equation of motion.

UNIT-II FORCED VIBRATION OF SINGLE DEGREE OF FREEDOM SYSTEMS: Introduction, Response of an Undamped system under harmonic force, Total response, Beating Phenomenon. Response of a Damped System under Harmonic Force- Total Response, Quality Factor and Bandwidth, Response of a Damped system under the Harmonic Motion of the base, Fore Transmitted, Relative Motion.

UNIT- III TWO DEGREE OF FREEDOM SYSTEMS: Introduction, Equations of Motion for forced Vibration, Free Vibration Analysis of and undamped system, Torsional system, Coordinate Coupling and Principal Coordinates, forded Vibration Analysis, Semi definite Systems, Self- Excitation and stability Analysis.

UNIT-IV MULTI-DEGREE OF FREEDOM SYSTEMS: Introduction Modeling of Continuous systems as Multi-degree of Freedom systems, Using Newton's second law to derive equations of motion, Influence Coefficients. Potential and kinetic energy expressions in matrix form, Generalized coordinates and generalized forces, Using Lagrange's equations to derive equations of motion, Equations of motion of undamped systems in matrix form, Eigen value problem, solution of the Eigen value problems – solution of the characteristic equation, orthogonality of normal modes, repeated Eigen values.

UNIT-V DETERMINATION OF NATURAL FREQUENCIES AND MODE SHAPES: Introduction, Dunkerley's formula, Rayleigh's Method- Properties of Rayleigh's Quotient, Computation of the Fundamental Natural Frequency, Fundamental Frequency of Beams and Shafts. Holzer;s Method- Torsional systems, Spring Mass Systems. Jacobis method, Standard Eigen value Problems.

REFERENCE:

1. Mechanical Vibrations/Groover/Nem Chand and Bros
2. Elements of Vibration Analysis by Meirovitch, TMH, 2001
3. Mechanical Vibrations/Schaum Series/ McGraw Hill
4. Mechanical Vibrations / SS Rao/ Pearson/ 2009, Ed 4,
5. Mechanical Vibrations/Debabrata Nag/Wiley
6. Vibration problems in Engineering / S.P. Timoshenko.
7. Mechanical Vibrations and sound engineering/ A.G.Ambekar/ PHI
8. Theory and Practice of Mechanical Vibrations/JS Rao & K. Gupta/New Age Intl. Publishers/Revised 2nd Edition

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DESIGN FOR MANUFACTURING OF MEMS
(PG Elective- I)

Prerequisites: None

Course objectives: the main objective of this course work is
- Understand the principles of MEMS and micro systems
- Engineering science for

Course Outcomes:
At the end of the course, the student will be able to
- Synthesize and characterize nanomaterials for engineering applications
- Design and analyze methods and tools for micro and nano manufacturing.
- Improve the quality of MEMS by analysing the variables of the underlying micro and nano manufacturing method
- Select appropriate industrially-viable process, equipment and tools for a specific product.

UNIT - I:
Overview and working principles of MEMS and Microsystems: MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & miniaturization, Applications of MEMs in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

UNIT - II:
Engineering Science for Microsystems Design and Fabrication: Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

UNIT - III:
Engineering Mechanics for Microsystems Design: Static Bending of Thin plates, Mechanical Vibration, Thermomechanics , Fracture Mechanics, Thin- Film Mechanics, Overview of Finite Element Stress Analysis

UNIT - IV:
Thermo Fluid Engineering & Microsystems Design: Overview of Basics of Fluid Mechanics in Macro and Mesoscales, Basic equations inContinum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid flow in Sub micrometer and Nano scale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

UNIT V:
Materials for MEMS & Microsystems and their fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

TEXT BOOK:
1. Tia-Ran Hsu, MEMS & Microsystems. Design & Manufacturing, TMH 2002
2. Foundation of MEMS/ Chang Liu/Pearson, 2012

REFERENCES:
1. Maluf, M., “An Introduction to Microelectromechanical Systems Engineering”. Artech House, Boston 2000
2. Trimmer , W.S.N., “Micro robots and Micromechnaical Systems”, Sensors & Actuators, Vol 19, 1989
3. Trim., D.W., “Applied Partial Differential Equations”., PWS-Kent Publishing, Boston, 1990

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THEORY OF METAL CUTTING AND TOOL DESIGN
(PG Elective- II)

Pre- requisites:
Engineering graphics, Mechanics of solids, Heat Transfer, Machine Tools, Strength of Materials.

Objectives:
1. To impart the knowledge of basic methodology of metal cutting.
2. To educate the student about the structure, working, forces involved in single point and multipoint cutting tools.
3. To understand the concepts of tool life, machinability, wear, influence of heat.
4. To design the jigs and fixtures required for machine tools.

Outcomes:
Students can analyse the machining process interms of input variables like
1. Speed, feed , depth of cut and their influence on surface roughness,
2. Metal removal rate, tool wear rate, machining time, energy, work done, heat distribution.

UNIT -I:
Mechanics of Metal Cutting: Geometry of Metal Cutting Process, Chip formation, Chip Thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut - Types of Chips, Chip breakers. Orthogonal and Oblique cutting processes-definition, Forces and energy calculations (Merchant's Analysis).- Power consumed – MRR – Effect of Cutting variables on Forces, Force measurement using Dynamometers.

UNIT -II:
Single Point Cutting Tool: Various systems of specifications, single point cutting tool geometry and their inter-relation. Theories of formation of built-up edge and their effect, design of single point contact tools throwaway inserts.

UNIT -III:
MultipointCutting Tools: Drill geometry, design of drills, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speed & feed – machining time – design - from cutters.
Grinding: Specifications of grinding of grinding wheel, mechanics of grinding, Effect of Grinding conditions on wheel wear and grinding ratio.Depth of cut, speed, machining time, temperature, power.

UNIT -IV:
Tool Life and Tool Wear: Theories of tool wear-adhesion, abrasive and diffusion wear mechanisms, forms of wear, Tool life criteria and machinability index.
Types of sliding contact, real area of contact, laws of friction and nature of frictional force in metal cutting. Effect of Tool angle, Economics, cost analysis, mean co-efficient of friction.
Cutting Temperature: Sources of heat in metal cutting, influence of metal conditions. Temperature distribution, zones, experimental techniques, analytical approach.Use of tool-work thermocouple for determination of temperature.Temperature distribution in Metal Cutting.

UNIT -V:
Tool Design: Determination of shank size for single point carbide tools, Determining the insert thickness for carbide tools. Design of jigs and fixtures: Basic principles of location and clamping; Locating methods and devices. Jigs- Definition, Types. General consideration in the design of Drill jigs, Drill bushing, Methods of construction.Fixtures- Vice fixtures, Milling, Boring, Lathe Grinding fixtures**.**

TEXT BOOKS:

1. Metal Cutting Principles / M C Shaw / Oxford and IBH Publications, New Delhi,1969
2. Fundamentals of Machining / Boothryd / Edward Amold publishers Ltd. 1975

REFERENCE BOOKS:

1. Metal cutting theory and cutting tool design / V. Arshinov and G. Alekseev / Mir Publishers, Moscow
2. Fundamentals of Metal cutting and Machine tools / B.L.Juneja, G. S. Sekhom and Nitin Seth / New Age International publishers
3. Machine Tool Engineering/ G.R.Nagpal/ Khanna Publishers

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PRECISION ENGINEERING
(PG Elective- II)

Pre Requisites: Metrology & Machine tools

Course Objectives:
Understand the tolerances according to ISO standards, selective assembly concept, principles of dimension chains, part and machine tools accuracy.

Course Outcomes:
At the end of the course, the student will be able to:
- Apply fits and tolerances for parts and assemblies according to ISO standards.
- Apply selective assembly concept for quality and economic production.
- Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
- Evaluate the part and machine tool accuracies.
- Analyze the causes for dimensional and geometrical errors prior to and during machining and suggest remedies

UNIT - I:
Concepts of Accuracy: Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags.
Geometric Dimensioning and Tolerancing: Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums –Datum Feature of Representation – Form Controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT - II:
Datum Systems: Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT - III:
Tolerance Analysis: Process Capability , Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances.
Tolerance Charting Techniques:Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples. Design features to facilitate machining; Datum Features – functional and manufacturing. Components design – Machining considerations, Redesign for manufactured, Examples

UNIT - IV
Surface finish, Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerances sure fit law, normal law and truncated normal law.
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UNIT - V:
Fundamentals of Nanotechnology: System of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing. MEASURING SYSTEMS PROCESSING :In processing or in-situ measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

TEXT BOOKS:

1. Precision Engineering in Manufacturing / murthy R. L., / New Age International (P) limited, 1996.
2. Geometric Dimensioning and Tolerancing / James D.Meadows / Marcel Dekker Inc.1995.

REFERENCE BOOKS:

1. Nano Technology / Norio Taniguchi / OxfordUniversity Press, 1996
2. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd, London.

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MECHATRONICS
(PG Elective- II)

Pre-requisites: To learn the importance and use of combination of mechanical & electronics.

Course objectives:
- They should be able to link up mechanical and electronics.
- To understand the need for metrology, machine tools, cad/cam, production technology.

Outcomes:
- Develop a relationship between mechanical elements and electronics elements for proper functioning of mechanical systems.
- At the end of the course, the student will be able to:
- Model, analyze and control engineering systems.
- Control the behaviour of a process using appropriate sensors, transducers and actuators.
- Develop PLC programs for a given task.
- Evaluate the performance of mechatronic systems.

UNIT-1:
Introduction: Definition of Mechanics products, Design Considerations and Tradeoffs. Overview of Mechatronics products.Intelligent Machine vs. Automatic.Machine Economic and Social justification.
Actuators and Motion Control: Characteristics of Mechanical, electrical, Hydraulic and pneumatic actuators and their limitations. Control parameters and system objectives. Mechanical configurations.Popular control system configurations.Popular control system configurations.S-curve, Motor/load inertia machining, design with linear studies.

UNIT-II:
Motion control Algorithms: Significance of feed control loops, shortfalls, fundamental concepts adaptive and fuzzy control, fuzzy logic compensatory control of transformation and deformation non – Z inearities

UNIT III:
Architecture of intelligent machines : Introduction to microprocessor and programmable logic controllers and identification of system, system design classification. Motion control aspects in design

UNIT IV:
Manufacturing Data bases: data base management systems, CAD/CAM data bases, Graphic data base, Introduction to object oriented concepts, Object oriented model languages interface, Procedure and Methods in creation, edition and manipulation of data

UNIT –V:
Sensor Interfacing: Analog and Digital sensors for Motion Measurement, Digital Transducers, Human machine and Machine-Machine interfacing devices and Strategy
Machine Vision: Future and Pattern Reorganization Methods, Concepts of Precision and cognition in decision making

TEXT BOOK:
1. Introduction to Mechatronics and Measurement Systems, Tata McGraw Hill

REFERENCES:
1. Designing Intelligent Machines, Michel B. Histand and David G. Alciatore, Open University London
2. Control Sensors and Actuators, ICW. Desiha, Prentice Hall

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PRODUCT DESIGN AND DEVELOPMENT
(PG Elective- III)

Prerequisites: None

Course Objectives:
- Understand the customer requirements
- Understand the concept of generation and selection by various methods.
- Understand the Product architecture & Industrial design

Course Outcomes:
- After doing this course, the student should be able to understand the need of Industrial Product & Development, customer needs & Design aspects of new products.
- Able to involve customer into the development of new products and managing requirements
- Able to understand the design of experiments and technical analysis
- Know product architecture
- Investigate the customer requirement and survey of problems
- Design for manufacture and do prototyping

UNIT- I:
Introduction: Need for IPPD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis
Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification.

UNIT II :
Concept generation and concept selection: Activity of concept generation – Structured approaches – Five step Method: clarify – Search-Externally and internally – explore systematically – reflect on the solutions and processes – **Concept selection** – Integral part of PDD process-methodology – benefits.

UNIT III:
Product architecture: Implications – Product change – variety – component standardization – product performance – manufacturability
Industrial design: Assessing the need for industrial design, impact – design process Integrate design process – assessing the quality of industrial design. ROBUST DESIGN-introduction, various steps in robust design.

UNIT IV:
Investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT –V:
Design for manufacturing: Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs –cost of supporting production. Minimizing System complexity.
Prototyping: Prototype basics – Principles of prototyping – planning for prototypes – Economic analysis.
Understanding and representing tasks – baseline project planning – accelerating the project execution.

TEXT BOOKS:

1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger /McGraw Hill International Edns. 1999.
2. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.

REFERENCE BOOKS:

1. Concurrent Engg/ integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)377-569, Workshop Book
2. Tool Design – Integrated Methodds for Successful Product Engineering / Staurt Pugh / Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5.

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VALUE ENGINEERING AND TOTAL QUALITY MANAGEMENT
(PG Elective- III)

Prerequisites: None

Course Objectives:

- Understand meaning of value of product
- Understand the procedure for improving the value of products through value analysis.
- Understand the concept of total quality management, principles & implementation aspects

Course Outcomes: At the end of the course student should be able

- To carry out value analysis for a given product so as to improve value of the product.
- To Implement TQM concept in the given organization.

Unit1

Introduction to Value Management Definition of value management History of values analysis Value Analysis verses Value Engineering Today's Opportunities Project selection Assembling the team •

Unit 2

Information gathering Design documents - drawings, specifications, etc. Material / component cost Cost Models Annual Purchase Values and Quantities Commodity data Sample components Reject rates Warranty data Commercial consideration Supplier Suggestions/Supplier Walk-through •

Unit 3

Functions Select target function(s) • Idea generation Creativity Brainstorming Process Idea starters Idea forms • Evaluation of Ideas Eliminate the Noise Estimate of Savings Cost to Implement Time to Implement Ranking of Ideas – A, B, C, D Evaluation Tools Selecting the Best Ideas • Development of Implementation Plans • Reporting • Management of Implementation plans

UNIT4

Introruction to Quality Management

Definitions – TOM framework, benefits, awareness and obstacles. Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed.

Process capability – meaning, significance and measurement – Six sigmaconcepts of process capability.Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve.Total productive maintenance (TMP) – relevance to TQM, Terotechnology. Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

UNIT 5

TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Quality functionsdevelopment (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven old (statistical) tools.Seven new management tools.Bench marking and POKA YOKE.

QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION

Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements.Quality Audits.TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward- Introduction to software quality.

TEXT BOOKS

1. Younker, DL, 2003, Value Engineering. Marcel Dekker, New Yo
2. Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education (First Indian Reprints 2004).
3. Shridhara Bhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.

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MANUFACTURING SYSTEMS, SIMULATION MODELLING AND ANALYSIS (PG Elective- III)

Pre requisites:
Operations Research, Optimization Techniques and Applications and Probability Statistics

Course Objectives: Understand the
- various simulation models
- Procedure for developing appropriate simulation model
- Procedure for analyzing simulation model

Course Outcomes : After doing this course, a student should be able to
- Identify a type of system based on type of its dynamics, ways of analyzing system
- Develop simulation model for dynamic discrete-event stochastic system and analyze for specified steady-state performance measures

UNIT - I:
System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers.

UNIT - I1:
Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model.Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

UNIT - III:
Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoullie – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

UNIT - IV :
Output data analysis – Types of Simulation w.r.t output dat analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

UNIT –V :
Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

TEXT BOOKS:
1. Simulation Modelling and Analysis / Law, A.M.& Kelton / McGraw Hill, 2nd Edition, New York, 1991.
2. Discrete Event System Simulation / Banks J. & Carson J.S., PH / Englewood Cliffs, NJ, 1984.
3. Simulation of Manufacturing Systems / Carrie A. / Wiley, NY, 1990.
4. A Course in Simulation / Ross, S.M., McMillan, NY, 1990.
5. Simulation Modelling and SIMNET / Taha H.A. / PH, Englewood Cliffs, NJ, 1987

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CAD/CAM Lab

Pre-requisites:
To give the exposure to usage of software tools for design and manufacturing. To acquire the skills needed to analyze and simulate engineering systems.

Course objectives:
- To be able to understand and handle design problems in a systematic manner.
- To be able to apply CAD in real life applications.
- To be understand the basic principles of different types of analysis.

Course out comes:
- To understand the analysis of various aspects in of Manufacturing design

Note: conduct any TEN excercises from the list gien below:

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.
13. Quality Control and inspection.

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ADVANCED MANUFACTURING PROCESS AND SYSTEMS LAB

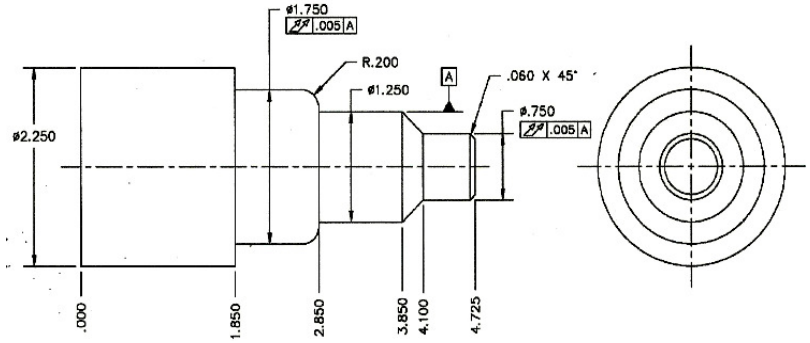
Prerequisites: Advanced Manufacturing Process

Course Objectives: Understand the CNC programming

Course: Should be able to write a CNC program for given part

Note : Conduct any Ten exercises from the list given below :

1. Write a program at the machine or off line. Setup the machining operation and perform standards given on lathe operations to develop a simple part (with linear and circular interpolations).



2. The bolt on the drawing made of AlMg1 is to be made on a CNC lathe in higher batch quantity. Prepare the manufacturing process with the MTS CNC Simulator including following steps: define work part zero, set up the processing sequence, determine tools, fixtures and technological data; generate, set up, test and correct the program at the CNC simulator. A bolt with an external diameter of ∅100 mm and the length of 93 mm is to be clamped for the test.

3. The jig plate on the drawing is to be produced on a CNC vertical milling machine from a blank of Al-alloy dimensioned 100 x 100 x 50 mm. Prepare the production on the CNC Simulator, work out the process layout and set-up form.

4. The contourplate on the drawing is to be produced on a CNC vertical milling machine from a blank of Al-alloy dimensioned 100 x 70 x 25 mm. Prepare the production on the MTS CNC Simulator, work out the process layout and set-up form.

5. Write a program to perform taper turning operations on Al-alloy workpiece of 40mm dia.

6. Write a program to perform thread cutting operations on Al-alloy workpiece of 40mm dia.

7. Write a program to perform rectangular and circular grooves on Al-alloy workpiece using CNC milling machine.

8. Robotic programming using SCARA

9. Low cost automation using pneumatic system – single cylinder exercise

10. Low cost automation using pneumatic system – double cylinder exercise

11. Metal cutting operations using EDM / ECM

12. Metal Cutting operations using AJM

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MANAGEMENT SCIENCE

Objective

The course introduces the basic concepts of Management Science and Operations Management and its application to business. The topics include human resource management, project and strategic management; the course develops problem solving and spreadsheet skills, an invaluable tool for modern business.

Learning outcome

- To enable students to gain an insight into different managerial decisions using standard techniques and problem structuring methods
- Students will be able to gain an understanding of the core concepts of Management Science and Operations Management;
- To understand the management issues in different functional areas of management namely operations and Human resources, strategy, marketing and project management.

Unit I Introduction to Management & Organisation: Concepts of Management and organization-nature, importance and Functions of Management, Systems Approach to Management - Taylor's Scientific Management Theory – Fayal's Principles of Management – Maslow's theory of Hierarchy of Human Needs – Douglas McGregor's Theory X and Theory Y – Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management. Designing Organisational Structures: Basic concepts related to Organisation - Departmentation and Decentralisation, Types and Evaluation of mechanistic and organic structures of organisation and suitability.

Unit II Operations & Marketing Management: Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement – Business Process Reengineering (BPR) - Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records – JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

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

Unit IV Project Management *(PERT/CPM)*: Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

Unit V *Strategic Management and Contemporary Strategic Issues*: Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced Score Card as Contemporary Business Strategies.

TEXTBOOKS:

1. Aryasri: *Management Science*, McGraw Hill, 2012.
2. Vijay Kumar and Appa Rao, *Management Science*, Cengage, 2012.

REFERENCES :

1. Kotler Philip & Keller Kevin Lane: Marketing Management, Pearson, 2012.
2. Koontz & Weihrich: *Essentials of Management*, McGraw Hill, 2012.
3. Thomas N.Duening & John M.Ivancevich *Management—Principles and Guidelines,* Biztantra, 2012.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2012.
5. Samuel C.Certo: *Modern Management*, 2012.
6. Schermerhorn, Capling, Poole & Wiesner: *Management*, Wiley, 2012.
7. Parnell: *Strategic Management*, Cengage,2012.
8. Lawrence R Jauch, R.Gupta &William F.Glueck: *Business Policy and Strategic Management*, Frank Bros.2012.

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OPTIMIZATION TECHNIQUES AND APPLICATIONS

Prerequisites: Operations Research

Objectives: After doing this subject student should know
- the various optimization techniques for single variable optimization problem
- Direct search methods and Gradient methods for multi variable un constraint Optimization problems
- Formulate a Geometric Programming model and solve it by using Arithmetic Geometric in equality theorem
- Simulate the system
- Thorough of state of art optimization techniques like Genetic Algorithms, simulated Annealing

Outcomes: For a given system, as per customer requirement it is required to
- Formulate optimization problem.
- Solve the problem by using a appropriate optimization techniques

UNIT- I*:*
Single Variable Non-Linear Unconstrained Optimization: Elimination methods :Uni-Model function-its importance, Fibonacci method,&Golden section method. Interpolation methods : Quadratic & Cubic interpolation methods.

UNIT- II:
Multi variable non-linear unconstrained optimization: Direct search methods – Univariantmethod , Pattern search methods – Powell's, Hook -Jeeves, Rosenbrock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method,& variable metric method.

UNIT- III:
Linear Programming – Formulation, Simplex method&Artificial variable optimization techniques: Big M & Two phase methods. Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition and deletion of variables, constraints.
Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

UNIT- IV:
Integer Programming- Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method
Stochastic Programming:Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

UNIT- V:
Geometric Programming: Posynomials – Arithmetic - Geometric inequality – unconstrained G.P-constrained G.P(≤ type only)
Non Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle-Simple Problems. Introduction to Particle Swarm Optimization(PSO)(very brief)

TEXT BOOKS:
1. Optimization theory & Applications / S.S.Rao / New Age International.
2. Optimization for Engineering Design, Kalyanmoy Deb, PHI

REFERENCE BOOKS:
1) S.D.Sharma / Operations Research
2) Operation Research / H.A.Taha /TMH
3) Optimization in operations research / R.LRardin
4) Optimization Techniques /Benugundu&Chandraputla / Pearson Asia.
5) Optimization Techniques theory and practice / M.C.Joshi, K.M.Moudgalya/ Narosa Publications

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ADVANCED FINITE ELEMENT & BOUNDARY METHODS
(PG Elective- IV)

Perquisites: None

Objectives:
1. To equip students with fundamentals of finite element principles.
2. To enable them to understand the behavior of various finite elements and to be able to select appropriate elements.
3. To solve physical and engineering problems with emphasis on structural and thermal engineering applications.

Course Outcomes:
At the end of the course, the student will be able to
- Understand the Finite Element Formulation procedure for structural Problems.
- Understand the representation and assembly considerations for Beam and Frame elements.
- Analyze Plane stress, Plane strain, axi-symmetric Problems.
- Formulate and solve simple heat transfer and fluid mechanics problems
- Identify significant applications of FEM in Manufacturing

UNIT - I:
Introduction to FEM: basic concepts, application of FEM, general description, advantages of FEM, comparison of FEM with other methods : finite difference method, variational method, Galerkin Method, basic element shapes, interpolation function. Virtual energy principle, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, basic equations of elasticity, strain displacement relations.

UNIT - II:
1-D structural problems : axial bar element – stiffness matrix, load vector, temperature effects, quadratic shape function, analysis of trusses – plane truss and space truss elements, Analysis of beams – Hermite shape functions, stiffness matrix, load vector problems, analysis.

UNIT - III:
2-D problems – CST, force terms, stiffness matrix and load vector, boundary conditions, Iso-parametric element, Quadric element, shape functions, Numerical Integration, 3-D problems – Tetrahedran element, Jacobian matrix, stiffness matrix.

UNIT - IV :
Scalar field problems – 1-D Heat conduction – 1-D fin element – 2-D heat conduction problems, torsion.

UNIT - V :
Dynamic considerations, Dynamic equations, consistent mass matrix, Eigen values, Eigen vector, natural frequencies, mode shapes, modal analysis.

TEXT BOOKS :
1. Finite Element Methods, Alavala, PHI
2. Introduction to finite elements in engineering – Tirupathi K. Chandrupatla and Ashok D. Belagundu.

REFERENCE BOOKS :
1. An Introduction to Finite Element Methods – S.S. Rao – Pegamon, New York.
2. The Finite element method in Engineering science – O.C. Aienkowitz, Mc. Graw Hill.
3. Concepts and applications of finite element analysis – Robert Cook.
4. Finite Element Methods in Engineering analysis – K.J. Bathe.

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QUALITY ENGINEERING IN MANUFACTURING
(PG Elective- IV)

Prerequisites: Metrology and machine tools

Objectives:

- To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices.
- To train them in the area of precision and quality manufacturing.

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

- Apply quality systems, principles, concepts.
- Utilize appropriate math, measurement and statistical tools.
- Technology to improve processes, product quality, and to enhance productivity.

UNIT- I: LASER METROLOGY AND PRECISION INSTRUMENTS Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – laser Doppler technique – laser Doppler anemometry - Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique vibrational deflectors – refractive and diffractive scanners. – laser gauging – bar coding – laser dimensional measurement system.

UNIT- II: CO-ORDINATE MEASURING SYSTEM Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – Displacement devices – performance evaluations – software – hardware – dynamic errors – thermal effects diagram – temperature variations - environment control – applications – Roll of CMM in reverse engineering.

UNIT- III: OPTO ELECTRONICS AND VISION SYSTEM Opto electronic devices – CCD – On-line and in-process monitoring in production - applications - image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system

UNIT- IV: QUALITY IN MANUFACTURING AND DESIGN ENGINEERING Importance of manufacturing planning for quality – initial planning and concept of quality – self controls – defining quality responsibilities on the factory flow – automated manufacturing – overall view of manufacturing planning – process quality audits – Opportunities for improvement in product design – early warning concepts and design assurance – design for basic functional requirements – design for reliability – availability – designing for manufacturability and safety – cost of quality – design review - concurrent engineering – improving the effectiveness of product development.

UNIT –V: QUALITY MANAGEMENT SYSTEM AND CONTINUOUS IMPROVEMENT Need for quality management system – design of quality management system – quality management system requirements – ISO 9001 and other management system and models – basic quality engineering tools - statistical process control – techniques for process design and improvement – Taguchi methods for process improvement – six sigma.

REFERENCES:

1. Oakland J.S. Total Quality Management – Text with cases, Butter worth – Heinemann – An imprint of Elseiver, First Indian Print, New Delhi 2005.
2. Elanchezhian.C, VijayaRamnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.
3. ZuechNello, Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000
4. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi, 1995.
5. Awcock, G.J. and Thomas R, Applied Image Processing, Mc.Graw Hill, Inc. 1996.

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ADDITIVE MANUFACTURING
(PG Elective- IV)

Prerequisites: None

Objectives:
To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

Course outcomes:
- To understand the fundamentals for additive manufacturing and how it is different and discuss about various types of liquid based, solid based and powder based AM technologies.
- To understand the various types of Pre-processing, processing, post-processing errors in AM. Also to know the various types of data formats and software's used in AM.
- To know the various applications of AM in design analysis, aerospace, automotive, biomedical and other fields

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

UNIT – II
Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Polyjet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Microfabrication.
Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT – III
Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies
Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

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

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

UNIT –V

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

Suggested Reading:

1. Rapid prototyping: Principles and Applications - Chua C.K., Leong K.F. and LIM C.S, World Scientific publications , Third Edition, 2010.
2. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001
3. Wholers Report 2000 – Terry Wohlers, Wohlers Associates, 2000
4. Rapid Prototyping & Engineering Applications – Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.

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IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) IV Year II-Sem

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ADVANCED COMPUTER AIDED DESIGN AND ANALYSIS LABORATORY

Note : Conduct any Ten exercises from the list given below :

1. Two- dimensional drawing using CAD software.
2. Three-dimensional drawing using CAD software.
3. Various Dimensioning and tolerancing techniques on typical products using CAD software.
4. Assembly and animation of simple assemblies like screw jack, bolt-nut mechanism, etc.
5. Truss analysis using FEA software.
6. Beam analysis using FEA software.
7. Frame analysis using FEA software.
8. Buckling analysis of columns using FEA software.
9. Harmonic analysis using FEA software.
10. Fracture analysis using FEA software.
11. Analysis of laminated composites using FEA software.
12. Couple-field analysis using FEA software.
13. Modal Analysis
14. Transient dynamic analysis.
15. Spectrum analysis.

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AUTOMATION IN MANUFACTURING

Prerequisites: Advanced Manufacturing Process

Objectives:

- Lower Cost and Improve Time-to-Market
- Automation investment life-cycle analysis
- Empowered teams of talented employees
- Partnering with automation suppliers
- On-line process analysis
- Procedural process control
- Information integration and data warehousing

Outcomes: Student will be able to

- Analyze online processes
- Understand how to lower the cost & improve the time to market
- Analyze life cycles of a product
- The importance of Information integration and data warehousing

UNIT-I:

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

UNIT-II:

Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT -III:

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

UNIT-IV:

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

UNIT-V:

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

TEXT BOOKS:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Eduction.

REFERENCE BOOKS:

1. CAD CAM : Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE)
2. Automation, Buckinghsm W, Haper& Row Publishers, New York, 1961
3. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

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DESIGN FOR MANUFACTURING AND ASSEMBLY
(PG Elective- V)

Prerequisites: None

Objectives:
At the end of this course the student should be able to apply the design for manufacturing principles in casting, welding, forming, machining and assembly, by considering various manufacturing constraints.

Course Outcomes: At the end of the course, the student will be able to
- Understand the quality aspects of design for manufacture and assembly.
- Apply Boothroyd method of DFM for product design and assembly.
- Apply the concept of DFM for casting, welding, forming and assembly.
- Identify the design factors and processes as per customer specifications.
- Apply the DFM method for a given product.

UNIT I:
Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design.
Materials: Selection of Materials for design – Developments in Material Technology – Criteria for material selection – Material selection interrelationship with process selection – process selection charts.

UNIT II:
MACHINING PROCESS: Overview of various machining processes – general design rules for machining - Dimensional tolerance and surface roughness – Design for Machining ease – Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts
METAL CASTING: Appraisal of various casting processes, Selection of casting process, General design considerations for casting – Use of Solidification Simulation in casting design – Product design rules for sand casting.

UNIT III
METAL JOINING: Appraisal of various welding processes, Factors in design of weldments – General design guidelines – pre and post treatment of welds – Effects of thermal stresses in weld joints – Design of brazed joints.
FORGING – Design factors for Forging – Closed die forging design – Location of parting lines of dies – Drop forging die design – General design recommendations

UNIT IV:
EXTRUSION, SHEET METAL WORK & PLASTICS: Design guidelines for Extruded sections - Keeler Goodman Forming Limit Diagram – Component Design for Blanking.
PLASTICS: Viscoelastic and Creep behavior in plastics – Design guidelines for Plastic components – Design considerations for Injection Moulding.

UNIT V:
DESIGN FOR ASSEMBLY: General design guidelines for Manual Assembly- Development of Systematic DFA Methodology- Assembly Efficiency- Classification System for Manual handling- Classification System for Manual Insertion and Fastening- Effect of part symmetry on handling time- Effect of part thickness and size on handling time- Effect of weight on handling time- Effect of symmetry , Further design guidelines.

TEXT BOOKS:
1. Engineering design-Material & Processing Approach/ George E. Deiter, Mc. Graw Hill Intl. 2nd Ed.2000.
2. Product design for Manufacture and Assembly/ Geoffrey Boothroyd/Marcel Dekker Inc. NY, 1994.

REFERENCE BOOKS:

1. Product design and Manufacturing / A.K Chitale and R.C Gupta / Prentice – Hall of India, New Delhi, 2003.
2. Design and Manufacturing / Surender Kumar &Goutham Sutradhar / Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.
3. Hand Book of Product Design/ Geoffrey Boothroyd Marcel Dekken Inc. NY, 1990.
4. Product Design/ Kevin Otto and Kristin Wood/ Pearson Education

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PRODUCTION AND OPERATIONS MANAGEMENT
(PG Elective- V)

Prerequisites: Operations Research, Production Planning and Control

Objectives:
- Learn Aggregate planning, MRP Work study, and scheduling
- Learn Value analysis, design the plant layout for the specified production system

Course Outcomes: At the end of the course, the student is able to
- Understand the importance of production and operations Management, for getting the Competitive edge
- Do value analysis for a given product and design the plant layout for the specified production system.
- Do Aggregate planning, MRP Work study, and scheduling
- able to apply the project management techniques

UNIT- I
Overview of Production & Operations Management (POM): Introduction-Definition-Importance-Historical Development of POM-POM scenario today
Product & Process design: Role of product development- Product development process-Tools for efficient product development(briefly)- Determination of process characteristics- Types of processes and operations systems- Continuous –Intermittent-Technology issues in process design- Flexible Manufacturing Systems- Automated Material Handling Systems

UNIT -II
Value Analysis:Defintion-Objectives-Types of Values-Phases- Tools -FAST diagram-Steps-Advantages-Matrix method-Steps.
Plant Location& Plant layout: Factors affecting locations decisions-Location planning methods-Location factor rating -Centre of Gravity method-Load distance method. Plant layout- Definition-Objectives-Types of layouts-Design of product layout-Line balance-Terminology-RPW method.

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

UNIT - IV
Work Study : Work study: method study –definition-objectives-steps-Charts used- Work measurement-Time study- Definition-steps- Determination of standard time- Performance rating-Allowances. Work sampling- steps- comparison with time study.
Quality Management: Economics of quality assurance-Control charts for variables and for attributes –Acceptance sampling plans-Total Quality Management-ISO 9000 series standards-Six sigma

UNIT - V
Scheduling: Need-basis for scheduling- Scheduling rules- Flow shop & Job shop scheduling. Line of Balance.
Project management: PERT- Critical path determination- Probability of completing project in a given time- CPM- Types of floats- Critical path determination- Crashing of simple networks- Optimum project schedule.

TEXT BOOKS:
1. Operations Management for Competitive Advantages- Chase Aquinano-TMH,2009
2. Operations Management: Theory and Practice: B.Mahadevan Pearson.
3. Industrial Engineering and Mangement: Dr.Ravi Shankar- Galgotia.

REFERENCES:

1. Modern Production and Operations Managemet: Buffa, Wiley
2. Theory and Problems in Production and Operations Managemet:SN Chary TMH.
3. Operations Management 8e Process and Value Chains: Lee Krajewskiet. all Pearson

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FLEXIBLE MANUFACTURING SYSTEMS
(PG Elective- V)

Prerequisites: None

Objectives:
Learn different types of FMS, Designing and analyzing the same using simulation and different analytical techniques.Helps to learn the tool management in FMS & to handle the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS

Course Outcomes: At the end of the course, the student shall be able to
- Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems.
- Explain processing stations and material handling system used in FMS environments.
- Design and analyze FMS using simulation and analytical techniques.
- Understand tool management in FMS.
- Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS

Unit1
Understanding of FMS: Evolution of Manufacturing Systems, Definition, objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push type

Unit 2
Classification of FMS Layout: Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc.

Unit3
Processing stations: Salient features Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station

Unit 4
Material Handling System: An introduction, Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS) Management technology: Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, routing, Production Planning and Control, Scheduling and loading of FMS

Unit 5
Design of FMS: Performance Evaluation of FMS, Analytical model and Simulation model of FMS Case studies: Typical FMS problems from research papers

Text books:
1. William W Luggen, “Flexible Manufacturing Cells and System” Prentice Hall of Inc New Jersey, 1991
2. Reza A Maleki “Flexible Manufacturing system” Prentice Hall of Inc New Jersey, 1991
3. John E Lenz “Flexible Manufacturing” marcel Dekker Inc New York ,1989.

References:
1. Groover, M.P “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall

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ADVANCED CASTING AND WELDING TECHNOLOGY
(PG Elective- VI)

Prerequisites: Production Technology, Heat transfer, FEM.

Objectives:
- To study the metallurgical concepts and applications of casting and welding process.
- To acquire knowledge in CAD of casting and automation of welding process.

Course Outcomes: At the end of the course, the student is able
- To impart the knowledge of advanced welding and casting techniques.
- To apply computer aided engineering to welding and casting.
- To analyse the advanced welding and casting processes and can relate variables with performance measures.

UNIT – I:
Laser Beam Welding: Types of lasers, equipment, power calculation, applications, dual laser beam welding, use of fibre optics in LBW.
Friction Stir Welding: Details of process and process parameters, specific applications.
Electron Beam Welding: The interaction of electron beam with matter, mode of heat generation, mode of energy losses, details of the equipment, product design for EBW, case studies.
Ultrasonic Welding: Propagation of ultrasonic waves in matter, mode of joint formation, joint types and design of product forultrasonic welding, details of equipment and case studies, cutting and gauging, flame cutting, plasma arc welding, laser assisted cutting.

UNIT – II:
Heat flow in welding: Significance, theory of heat flow, cooling rate determination, selection of welding parameters based on heat flow analysis, residual stresses and distortion. Joint design, analysis of fracture and fatigue of welded joints.Automated welding systems.

UNIT - III:
Investment casting, shell moulding, squeeze casting, vacuum casting, counter-gravity flow - pressure casting, directional and monocrystal solidification, squeeze casting, semisolid metal casting, rheocasting, .

UNIT –IV:
Solidification, Gating and Risering, Nucleation and grain growth, solidification of pure metals, short and long freezing range alloys. Gating and riseringdesing calculations, Fluidity and its measurement.

UNIT - V:
CAE Of Welding And Casting: Design of weldment, application of finite element method in welding – determination of distortion in weldments, modeling of temperature distribution - case studies. Design for casting, application of finite element method in casting - determination of hot spots, location of turbulence and other defects, modeling of flow in molds, modeling of heat transfer in castings – case studies.

REFERENCE BOOKS:
1. Ravi B, “Metal Casting: Computer Aided Design and Analysis”, Prentice Hall, 2005.
2. Richard L Little, “Welding and Welding Technology”, Tata McGraw Hill, 2004.
3. John Campbell, “Casting Practice”, Elsevier Science Publishing Co., 2004.
4. Larry Jeffus, "Welding: Principles and Applications", Delmar Publishers, 2004.
5. John Campbell, "Casting", Butterworth Heinemann, 2003.
6. KlasWeman, “Welding Processes Handbook”, 2003.
7. Howard B Cary, “Modern Welding Technology”, Prentice Hall, 2002.
8. Larry Jeffus, “Welding for Collision Repair”, Delmar Publishers, 1999.
9. ASM Hand Book, “Casting”, ASM International, 1998.

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MATERIAL TECHNOLOGY
(PG Elective- VI)

Perquisites: Mechanics of solids

Objectives:

- To make the students to understand on elastic, plastic and fractured behaviour of engineering materials.
- To train the students in selection of metallic and non-metallic materials for the various engineering applications.

Course Outcomes:

- Apply phase transformation phenomena to improve the performance of materials.
- Apply principles of deformation to modify structure and properties of materials.
- Characterize and evaluate materials for specific applications.
- Design metallurgical processes to produce products as per specifications.
- Evaluate products using non-destructive testing methods and modify processes.
- Identify mechanisms for protecting engineering materials from degradation.
- Synthesize ceramic, polymer, composite and non-ferrous materials.
- Design advanced materials for aerospace, biological, nuclear and high temperature applications.
- Apply project management techniques effectively to address issues related to metallurgical industries.
- Practice professional ethics and engage in lifelong learning for improved professional advancement, moral and human values.

UNIT – I:

Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening

Poly phase mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material.

UNIT – II:

Griffth's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson – Miller Parameter, Deformation and Fracture mechanism maps.

UNIT – III:

Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

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UNIT – IV:

Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, Auto, Marine, Machinery and Nuclear Applications.

Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep

UNIT – V:

Modern Metallic Materials: Dual Phase Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Intermetallics, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass, Quasi Crystal and Nano Crystalline Materials.

Nonmetallic Materials: Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, Structure, Properties and Applications of engineering

Polymers, Advanced Structural Ceramics WC, TiC, TaC, Al2 O3 , SiC, Si3 N4 , CBN and Diamond – properties, Processing and applications.

TEXT BOOKS:

1. Mechanical Behaviour of Materials, Thomas H. Courtney, 2nd Edition, McGraw Hill,2000.
2. Mechanical Metallurgy, George E. Dieter, McGraw Hill,1998.

REFERENCE BOOK:

1. Selection and use of Engineering Materials,Charles J.A, Butterworth Heiremann.

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IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) V Year II-Sem

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INDUSTRIAL ROBOTICS
(PG Elective- VI)

Prerequisites: Kinematics of machinery

Objectives:
To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

Course Outcomes: After doing this course, the student should be able to
- Understand the evolution, classification, structures and drives for robots.
- To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors
- To expose the students to build a robot for any type of application

UNIT I
Introduction: Automation and Robotics, Robot configuration, motions, joint notation, work volume, robot drive system, Robot actuators: Internal & External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics. End Effectors:Types, operation, mechanism, force analysis, consideration in gripper selection and design.RobotVision:Basics and steps, Robot Programming Methods.

UNIT II:
Motion Analysis and Control: Manipulator kinematics, position representation, Basic and Composite Rotation Matrices, Equivalent Axis and Angle – Euler Angles - Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward & Inverse transformations, problems on planar & spatial manipulators,

UNIT III:
Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated & Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending.

UNIT IV:
Robot Dynamics: Lagrange – Euler & Newton - Euler formulations, problems on two link planar manipulators.

UNIT V:
Robot Cell Design and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller.
Robot Applications: Material transfer, Machine loading/unloading. Processing operations, Assembly and Inspection, Future Applications.

TEXT BOOKS:
1. Robot Analysis and Control /Asada H. and J. E. Slotin, Wiley, New York
2. Theory of Applied Robotics: Kinematics , Dynamics and Control/ Reza N. Jazar, Springer, India

REFERENCE BOOKS:
1. Industrial robotics / MikellP.Groover / McGraw Hill
2. Robotics / K.S.Fu / McGraw Hill.
3. Introduction to Robotics Mechanics & Control/ John J.Craig/Pearson
4. Robot Analysis/Lung Wen Tsai/John Wiley & Sons
5. Robotics & Control/RK Mittal & IJ Nagrath/ Tata Mc-GrawHill

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NANOTECHNOLOGY
(PG Elective- VII)

Prerequisites: None

Objectives:
- To expose the students to the evolution of Nano systems, to the various fabrication techniques.
- Also to impart knowledge to the students about nano materials and various nano measurements techniques.

Course outcomes:
- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- An ability to function on multidisciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

UNIT- I: OVER VIEW OF NANOTECHNOLOGY 6 Definition – historical development – properties, design and fabrication Nanosystems, working principle ,applications and advantages of nano system. Nanomaterials – ordered oxides – Nano arrays – potential health effects

UNIT –II: NANODEFECTS, NANO PARTILES AND NANOLAYERS 8 Nanodefects in crystals – applications – Nuclear Track nano defects. Fabrication of nano particles – LASER ablation – sol gels – precipitation of quantum dots.Nano layers – PVD,CVD ,Epitaxy and ion implantation – formation of Silicon oxide- chemical composition – doping properties – optical properties

UNIT- III: NANOSTRUCTURING 8 Nanophotolithography – introduction – techniques – optical – electron beam – ion beam – X-ray and Synchrotron – nanolithography for microelectronic industry – nanopolishign of Diamond – Etching of Nano structures – Nano imprinting technology – Focused ion beams - LASER interference Lithography nanoarrays –Near-Field Optics - case studies and Trends

UNIT- IV: SCIENCE AND SYNTHESIS OF NANO MATERIALS 12 Classification of nano structures – Effects of nano scale dimensions on various properties – structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics –Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture Nanoparticles, Sol-Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nanotubes – Solid carbon source based production techniques – Gaseous carbon source based production techniques – Diamond like carbon coating. Top down and bottom up processes.

UNIT –V: CHARACTERIZATION OF NANO MATERIALS 11 Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, confocal LASER scanning microscopy - transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. FahrnerW.R.,Nanotechnology and Nanoelectronics, Springer (India) Private Ltd., 2011.
3. Mark Madou , Fundamentals of Microfabrication, CRC Press, New York, 1997.
4. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
5. Mohamed Gad-el-Hak, MEMS Handbook, CRC press, 2006, ISBN : 8493-9138-5
6. Waqar Ahmed and Mark J. Jackson, Emerging Nanotechnologies for Manufacturing, Elsevier Inc.,2013,ISBN : 978-93-82291-39-8 29
7. Sami Franssila, Introduction to Micro fabrication , John Wiley & sons Ltd, 2004.ISBN:470-85106-6
8. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
9. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

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NEURAL NETWORKS AND FUZZY LOGICS
(PG Elective- VII)

Perquisites: None

Objectives:
- Understand the concepts of artificial neural Networks
- Understand the topology of multi layer perception
- Understand the recurrent neural networks
- Understand the concepts of fuzzy logics

Course Outcomes:
One should be able to develop neural networks and fuzzy logics to a system and analyze.

UNIT-I :Evolution of neural networks; Artificial Neural Network: Basic model, Classification, Feed forward and Recurrent topologies, Activation functions; Learning algorithms: Supervised, Un-supervised and Reinforcement; Fundamentals of connectionist modeling: McCulloach – Pits model, Perceptron, Adaline, Madaline.

UNIT–II :Topology of Multi-layer perceptron, Back propagation learning algorithm, limitations of Multi-layer perceptron. Radial Basis Function networks: Topology, learning algorithm; Kohenen's self-organising network: Topology, learning algorithm; Bidirectional associative memory Topology, learning algorithm, Applications.

UNIT–III :Recurrent neural networks: Basic concepts, Dynamics, Architecture and training algorithms, Applications; Hopfield network: Topology, learning algorithm, Applications; Industrial and commercial applications of Neural networks: Semiconductor manufacturing processes, Communication, Process monitoring and optimal control, Robotics, Decision fusion and pattern recognition.

UNIT–IV: Classical and fuzzy sets: Introduction, Operations and Properties, Fuzzy Relations: Cardinality, Operations and Properties, Equivalence and tolerance relation, Value assignment: cosine amplitude and max-min method; Fuzzification: Membership value assignment- Inference, rank ordering, angular fuzzy sets. Defuzzification methods, Fuzzy measures, Fuzzy integrals, Fuzziness and fuzzy resolution; possibility theory and Fuzzy arithmetic; composition and inference; Considerations of fuzzy decision-making.

UNIT-V
Basic structure and operation of Fuzzy logic control systems; Design methodology and stability analysis of fuzzy control systems; Applications of Fuzzy controllers. Applications of fuzzy theory.

Suggested Reading:
1. Limin Fu, *"Neural Networks in Computer Intelligence,"* McGraw Hill, 2003.
2. Fakhreddine O. Karray and Clarence De Silva., *"Soft Computing and Intelligent Systems Design, Theory, Tools and Applications,"* Pearson Education, India, 2009.
3. Timothy J. Ross, *"Fuzzy Logic with Engineering Applications,"* McGraw Hill,1995.
4. B.Yegnanarayana, *"Artificial Neural Networks,"* PHI, India, 2006.

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SCALING LAWS AND MICRO MANUFACTURING
(PG Elective-VII)

Prerequisites: Unconventional machining process

Objectives:
Understanding the micro machining processes like abrasive jet micro machining, electro discharging micro machining, nano policing , Micro forming and welding etc

Course outcomes: After doing this course, the student should be able to
- Understand various micro machining processes
- learn about nano polishing and micro forming and welding

UNIT- I: MICRO MACHINING I Mechanical Micro machining – Ultra Sonic Micro Machining – Abrasive Jet Micro Machining – Water Jet Micro Machining – Abrasive Water Jet Micro Machining – Micro turning – Chemical and Electro Chemical Micro Machining – Electric discharge micro machining.

UNIT- II: MICRO MACHINING II Beam Energy based micro machining – Electron Beam Micro Machining – Laser Beam Micro Machining – Electric Discharge Micro Machining – Ion Beam Micro Machining –Plasma Beam Micro Machining – Hybrid Micro machining – Electro Discharge Grinding – Electro Chemical spark micro machining – Electrolytic in process Dressing.

UNIT-III : NANO POLISHING Abrasive Flow finishing – Magnetic Abrasive Finishing – Magneto rheological finishing – Magneto Rheological abrasive flow finishing - Magnetic Float polishing – Elastic Emission Machining – chemomechanicalPolishining.

UNIT- IV: MICRO FORMING AND WELDING Micro extrusion – Micro and Nano structured surface development by Nano plastic forming and Roller Imprinting – Micro bending with LASER – LASER micro welding – Electron beam for micro welding.

UNIT- V: RECENT TRENDS AND APPLICATIONS Metrology for micro machined components – Ductile regime machining– AE based tool wear compensation– Machining of Micro gear, micro nozzle, micro pins – Applications.

REFERENCES:
1. Jain V. K., Micro Manufacturing Processes, CRC Press, Taylor & Francis Group, 2012 1. Janocha H., Actuators – Basics and applications, Springer publishers – 2012
2. Jain V.K., ‗Introduction to Micro machining' Narosa Publishing House, 2011
3. Bharat Bhushan, Handbook of nanotechnology, springer, Germany, 2010.
4. Bandyopadhyay. A.K., Nano Materials, New age international publishers, New Delhi, 2008, ISBN:8122422578.
5. Jain V.K., Advanced Machining Processes, Allied Publishers, Delhi, 2002
6. Mcgeoug.J.A., Micromachining of Engineering Materials, CRC press 2001, ISBN-10:0824706447.
7. www.cmxr.com/industrial/ 8. www.sciencemag.org.handbook

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PG PROJECT STAGE-1

DISSERTATION PART – A

Prerequisites: None

Course Outcomes:
- Identify a topic in advanced areas of Advanced Manufacturing Systems, materials
- Review literature to identify gaps and define objectives & scope of the work
- Employ the ideas from literature and develop research methodology
- Develop a model, experimental set-up and / or computational techniques necessary to meet the objectives.

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SEMINAR

Prerequisites: None

Course Objectives:
Reading and understand of the research papers publish in the relevant field.

Course Outcomes:
At the end of the course, the student will be able to:
- Identify and compare technical and practical issues related to the area of course specialization.
- Outline annotated bibliography of research demonstrating scholarly skills.
- Prepare a well organized report employing elements of technical writing and critical thinking
- Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

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PG Project Stage-II

DISSERTATION PART – B

Prerequisites: None

Course Outcomes:
- Identify methods and materials to carry out experiments/develop code
- Reorganize the procedures with a concern for society, environment and ethics
- Analyze and discuss the results to draw valid conclusions
- Prepare a report as per the recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

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COMPREHENSIVE VIVA – VOCE

Prerequisites:
Knowledge of All the subjects of all semesters.

Objectives:
Having Idea and awareness of concepts of subjects studied during all semesters.

Course Outcomes:
- Comprehend the knowledge gained in the course work
- Infer principles of working of mechanical components
- Demonstrate the ability in problem solving and to communicate effectively

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DISASTER MANAGEMENT
OPEN ELECTIVE-I

Pre Requisites: NIL

Course Objectives:
The subject provide different disasters, tools and methods for disaster management

Course Outcomes:
Estimate, perform quantity survey & valuate various engineering works

UNIT 1 : Understanding Disaster
Concept of Disaster
Different approaches
Concept of Risk
Levels of Disasters
Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerability
Natural and man-made hazards; response time, frequency and forewarning levels of different hazards
Characteristics and damage potential or natural hazards; hazard assessment
Dimensions of vulnerability factors; vulnerability assessment
Vulnerability and disaster risk
Vulnerabilities to flood and earthquake hazards

UNIT 2 : Disaster Management Mechanism
Concepts of risk management and crisis managements
Disaster Management Cycle
Response and Recovery
Development, Prevention, Mitigation and Preparedness
Planning for Relief

UNIT 3: Capacity Building
Capacity Building: Concept
Structural and Nonstructural Measures
Capacity Assessment; Strengthening Capacity for Reducing Risk
Counter-Disaster Resources and their utility in Disaster Management
Legislative Support at the state and national levels

UNIT 4: Coping with Disaster
Coping Strategies; alternative adjustment processes
Changing Concepts of disaster management
Industrial Safety Plan; Safety norms and survival kits
Mass media and disaster management

UNIT 5: Planning for disaster management
Strategies for disaster management planning
Steps for formulating a disaster risk reduction plan
Disaster management Act and Policy in India
Organizational structure for disaster management in India
Preparation of state and district disaster management plans

Text Books

1. Alexander, D. Natural Disasters, ULC press Ltd, London, 1993.
2. Carter, W.N. Disaster Management: A Disaster Management Handbook, Asian Development Bank, Bangkok, 1991.
3. Manual on Natural Disaster Management in India, NCDM, New Delhi, 2001.

References

1. Abarquez I. & Murshed Z. Community Based Disaster Risk Management: Field Practitioner's Handbook, ADPC, Bangkok, 2004.
2. Goudie, A. Geomorphological Techniques, Unwin Hyman, London 1990.
3. Goswami, S.C Remote Sensing Application in North East India, Purbanchal Prakesh, Guwahati, 1997.
4. Chakrabarty, U.K. Industrial Disaster Management and Emergency Response, Asian Book Pvt. Ltd., New Delhi 2007.
5. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. National Policy on Disaster Management, NDMA, New Delhi, 2009
7. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.
8. District Disaster Management Plan-Model Template, NIDM, New Delhi, 2005.
9. Disaster Management, Future challenge and opportunities, Edited by Jagbir singh, I.K. International publishing home Pvt, Ltd.

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NON CONVENTIONAL POWER GENERATION
OPEN ELECTIVE-I

Pre-requisite: Nil.

Objectives:

- To introduce various types of renewable technologies available.
- The technologies of energy conversion from these resources and their quantitative analysis.

Outcomes:

- The student will be able analyse solar thermal and photovoltaic systems and related technologies for energy conversion.
- Wind energy conversion and devices available for it.
- Biomass conversion technologies.
- Geo thermal resources and energy conversion principles and technologies.
- Power from oceans (thermal, wave, tidal) and conversion and devices.
- Fundamentals of fuel cells and commercial batteries.

UNIT - I

Fundamentals of Solar Energy-Solar spectrum- Solar Radiation on Earth's surface-Solar radiation geometry-Solar radiation measurements- Solar radiation data- Solar radiation on horizontal and tilted surfaces. Solar Thermal conversion- Flat plate collectors- concentrated collectors- construction and thermal analysis- Solar applications- Solar ponds- Heliostat systems-water heater-air heater-solar still.

UNIT - II

Solar-Electric Power generation- Photovoltaic cells- Equivalent circuit- V-I Characteristics-Photovoltaic modules – constructional details- design considerations- Tracking- Maximum power point tracking - Solar Thermo electric conversion.

UNIT - III

Wind Energy- Fundamentals of wind energy-power available in wind- Betz Limit-Aerodynamics of wind turbine- Wind turbines- Horizontal and vertical axis turbines –their configurations- Wind Energy conversion systems.

UNIT - IV

Energy from Bio Mass- Various fuels- Sources-Conversion technologies-Wet Processes – Dry Processes- Bio Gas generation – Aerobic and anaerobic digestion - Factors affecting generation of bio gas - Classification of bio gas plants-Different Indian digesters- Digester design considerations - Gasification process - Gasifiers – Applications. Geothermal Energy - sources- Hydrothermal convective - Geo-pressure resources - Petro-thermal systems (HDR) - Magma Resources-Prime Movers.

UNIT - V

OTEC Systems- Principle of operation - Open and closed cycles, Energy from Tides - Principle of Tidal Power - Components of tidal Power plants - Operation Methods - Estimation of Energy in Single and double basin systems - Energy and Power from Waves-Wave energy conversion devices - Fuel Cells - Design and Principle of operation - Types of Fuel Cells - Advantages and disadvantages - Types of Electrodes – Applications - Basics of Batteries - Constructional details of Lead acid batteries - Ni-Cd Batteries.

TEXT BOOKS

1. John Twidell & Wier, Renewable Energy Resouces, CRC Press, 2009.
2. G.D.Rai – Non Conventional Energy sources, Khanna publishers.

REFERENCE BOOKS

1. D.P .Kothari, Singal,Rakesh, Ranjan, Renewable Energy sources and Emerging Technologies, PHI, 2009.
2. F.C.Treble, Generating Electricity from Sun.
3. C.S.Solanki, Solar Photo volatics- Fundamentals- Principles and Applications, PHI 2009
4. S.P.Sukhatme, Solar Energy Principles and Application - TMH

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ELECTRICAL ENGINEERING MATERIALS
OPEN ELECTIVE-I

Pre-requisites: Nil

Objectives: To understand the importance of various materials used in electrical engineering and obtain a qualitative analysis of their behavior and applications.

OUTCOMES: Will be able to

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Materials used in electrical engineering and applications.

UNIT- I
DIELECTRIC MATERIALS: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT – II
MAGNETIC MATERIALS: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. factors effecting permeability and hysteresis

UNIT – III
SEMICONDUCTOR MATERIALS: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).

UNIT – IV
MATERIALS FOR ELECTRICAL APPLICATIONS: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT – V
SPECIAL PURPOSE MATERIALS: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI

TEXT BOOKS

1. R K Rajput: A course in Electrical Engineering Materials, Laxmi Publications. 2009
2. T K BasaK: A course in Electrical Engineering Materials:, New Age Science Publications 2009
3. TTTI Madras: Electrical Engineering Materials
4. Adrianus J.Dekker: Electrical Engineering Materials, THM Publication.

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NANO-TECHNOLOGY
OPEN ELECTIVE-I

Pre-requisites: Nil

OBJECTIVES:
To enable the student to understand fundamentals of nano materials and technologies for these materials and their manufacturing, applications in various fields.

OUTCOMES:
- To evaluate electronic structural studies of nano materials and different synthesis methods to obtain nano structures.
- Understand characterization techniques through various measurements to study electrical, mechanical,thermal properties of nano materials.
- Applications of nano materials for specific purposes like MEMS, NEMS, nano electronics, energy storage.

UNIT - I
Background of Nanotechnology: Scientific Revolutions, Nanotechnology and Nanomachines - The Periodic Table, Atomic Structure, Molecules and Phases, Energy, Molecular and Atomic size, Surfaces and Dimensional Space, Top down and Bottom up approach.

UNIT - II
Molecular Nanotechnology: Atoms by inference, Electron Microscopes, Scanning electron microscope, Modern transmission electron microscope, Scanning probe microscope-atomic force microscope, scanning, tunneling microscope, Self Assembly.

UNIT - III
Nanopowders and Nanomaterials: Preparation, Plasma arcing, chemical vapor deposition, Sol-gels, Electrodeposition, Ball milling, using natural nanoparticles, Applications of nanomaterials.

UNIT - IV
Nanoelectronics: Approaches to nanoelectronics, Fabrication of integrated circuits, MEMS, NEMS, Nano circuits, Quantum wire, Quantum well, DNA-directed assembly and application in electronics.

UNIT - V
Applications: MEMS, NEMS, Coatings, Optoelectronic Devices, Environmental Applications, Nanomedicine.

TEXT BOOKS
1. Introduction to Nanoscience and Nanotechnology Gabor L. Hornyak, **NanoThread, Inc., Golden, Colorado, USA**; H.F. Tibbals, **University of Texas Southwestern Medical Center, Dallas, USA**; Joydeep Dutta, **Asian Institute of Technology, Pathumthani, Thailand**; John J. Moore, **Colorado School of Mines, Golden, USA**
2. Introduction to Nanotechnology by Charles P. Poole Jr and Frank J.Owens Wiley India Pvt Ltd.
3. Introduction to Nanoscience and Nanotechnology, Chatopadhyaya.K.K, and Banerjee A.N,
4. Introduction to nano tech by phani kumar
5. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens. Wiley India Pvt Ltd.
6. Introduction to Nanoscience and Nanotechnology, Chatopadhyaya.K.K, and Banerjee A.N,

NANOTECHNOLOGY Basic Science and EmergingTsechnologies by Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse**-** CHAPMAN & HALL/CRC PRESS 2002.

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OPERATIONS RESEARCH
OPEN ELECTIVE-I

Prerequisites: None

Objectives:
Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

Outcomes:
Understanding the problem, identifying variables & constants, formulas of optimization model and applying appropriate optimization Techniques

UNIT – I
Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.
ALLOCATION: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT – II
TRANSPORTATION PROBLEM – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.
Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT – III
SEQUENCING – Introduction – Flow **–**Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines-graphical model
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
THEORY OF GAMES: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.
INVENTORY: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

UNIT – V
WAITING LINES: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.
DYNAMIC PROGRAMMING:
Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming-shortest path problem – linear programming problem.

TEXT BOOK :
1. Operation Research /J.K.Sharma/ MacMilan.
2. Operations Research/A.C.S.Kumar/Yesdee

REFERENCE BOOKS :
1. Operations Research: Methods and Problems / Maurice Saseini, Arhur Yaspan and Lawrence Friedman
2. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
3. Operations Research / Wagner/ PHI Publications.
4. Introduction to O.R/Hillier & Libermann (TMH).
5. Introduction to O.R /Taha/PHI

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BASICS OF THERMODYNAMICS
OPEN ELECTIVE-I

Pre-requisite: Engineering Chemistry and Physics

Course Objective: To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications

Course Outcomes:
At the end of the course, the student should be able to
- Understand and differentiate between different thermodynamic systems and processes
- Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes
- Understand and analyze the Thermodynamic cycles

UNIT – I
Introduction: Basic Concepts:
System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle, Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility

UNIT II
Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale

UNIT – III
First and Second Laws of Thermodynamics: First Law: Cycle and Process, Specific Heats (cp and cv), Heat interactions in a Closed System for various processes, Limitations of First Law, Concept of Heat Engine (H.E.) and Reversed H.E. (Heat Pump and Refrigerator), Efficiency/COP, Second Law: Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, Statement of Clausius Inequality, Property of Entropy, T-S and P-V Diagrams

UNIT IV
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.
Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, , Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation ,Psychrometric chart.

UNIT - V
Power Cycles : Otto, Diesel cycles - Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis
Refrigeration Cycles:
Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS :
1. Engineering Thermodynamics / PK Nag /TMH, III Edition
2. Thermodynamics / C.P.Arora.

REFERENCE BOOKS:
1. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
2. Fundamentals of Classical Thermodynamics – G. Van Wylan & R.E. Sonntag – John Wiley Pub.
3. Thermodynamics – J.P.Holman / McGrawHill
4. Engineering Thermodynamics – Jones & Dugan
5. Thermodynamics & Heat Engines – Yadav – Central Book Depot, Allahabad.

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FABRICATION PROCESSES
OPEN ELECTIVE-I

Prerequisites: Nil

Objectives:
Understand the philosphipies of various Manufacturing process.

Outcomes:
For given product, one should be able identify the manufacturing process.

UNIT – I
Casting : Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.
Methods of Melting - Crucible melting and cupola operation – Defects in castings;
Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

UNIT – II
Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.
Inert Gas Welding _ TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non-destructive testing of welds.

UNIT – III
Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth.
Stamping, forming and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.
Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – IV
Extrusion of Metals : Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

UNIT – V
Forging Processes : Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers : Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS :
1. Manufacturing Technology / P.N. Rao/TMH

REFERENCE BOOKS :
1. Production Technology / R.K. Jain
2. Metal Casting / T.V Ramana Rao / New Age
3. Principles of Metal Castings / Rosenthal.
4. Welding Process / Parmar /
5. Production Technology /Sarma P C /
6. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.

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ELECTRONIC MEASURING INSTRUMENTS
OPEN ELECTIVE-I

Note: No detailed mathematical treatment is required.

Prerequisite : Nil

Course Objectives:

- It provides an understanding of various measuring systems functioning and metrics for performance analysis.
- Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes:

On completion of this course student can be able to

- Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
- Measure various physical parameters by appropriately selecting the transducers.
- Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

Unit-I:

Block Schematics of Measuring Systems and Performance Metrics: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

Unit-II:

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, and Specifications.

Unit-III:

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes.

Unit-IV:

Recorders: X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo transducers, pen driving mechanisms, Magnetic Recording, Magnetic recording techniques.

Unit-V:

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

TEXT BOOKS:

1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

REFERENCES:

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

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OBJECT ORIENTED PROGRAMMING THROUGH JAVA
OPEN ELECTIVE-I

Prerequisites

1. A course on "Computer Programming & Data Structures"

Objectives

1. Introduces object oriented programming concepts using the Java language.
2. Introduces the principles of inheritance and polymorphism; and demonstrates how they relate to the design of abstract classes
3. Introduces the implementation of packages and interfaces
4. Introduces exception handling, event handling and multithreading
5. Introduces the design of Graphical User Interface using applets and swings

Outcomes

1. Develop applications for a range of problems using object-oriented programming techniques
2. Design simple Graphical User Interface applications

UNIT I:

Object oriented thinking and Java Basics- Need for OOP paradigm, summary of OOP concepts, coping with complexity, abstraction mechanisms. A way of viewing world – Agents, responsibility, messages, methods, History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, method binding, inheritance, overriding and exceptions, parameter passing, recursion, nested and inner classes, exploring string class.

UNIT II:

Inheritance, Packages and Interfaces – Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class.

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces, Exploring java.io.

UNIT III:

Exception handling and Multithreading-- Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

String handling,Exploring java.util.Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter-thread communication, thread groups, daemon threads, Enumerations, auto boxing, annotations, generics.

UNIT IV:

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scroll pane, dialogs, menu bar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

UNIT V:

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

TEXT BOOKS:

1. Java the complete reference, 7th editon, Herbert Schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.

REFERENCES:

1. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John Wiley & Sons.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. An introduction to Java programming and object oriented application development, R.A. Johnson-Thomson.

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COMPUTER GRAPHICS
OPEN ELECTIVE-I

Prerequisites
1. Familiarity with the theory and use of coordinate geometry and of linear algebra such as matrix multiplication.
2. A course on "Computer Programming and Data Structures"

Objectives
1. The aim of this course is to provide an introduction of fundamental concepts and theory of computer graphics.
2. Topics covered include graphics systems and input devices; geometric representations and 2D/3D transformations; viewing and projections; illumination and color models; animation; rendering and implementation; visible surface detection;

Outcomes
1. Acquire familiarity with the relevant mathematics of computer graphics.
2. Be able to design basic graphics application programs, including animation
3. Be able to design applications that display graphic images to given specifications

UNIT-I:
Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices
Output primitives: Points and lines, line drawing algorithms (Bresenham's and DDA Algorithm), mid-point circle and ellipse algorithms
Filled area primitives: Scan-line polygon fills algorithm, boundary-fill and flood-fill algorithms

UNIT-II:
2-D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems
2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm, Polygon Filling

UNIT-III:
3-D object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods.

UNIT-IV:
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.
3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT-V:
Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.
Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods

Text Books:

1. "Computer Graphics *C version*", Donald Hearn and M.Pauline Baker, Pearson Education
2. "Computer Graphics Principles & practice", second edition in C, Foley, Van Dam, Feiner and Hughes, Pearson Education.
3. Computer Graphics, Steven Harrington, TMH

References:

1. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
2. Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
3. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.

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IDP (B.Tech. Mech. Engg. & M.Tech. /MBA) III Year I-Sem

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ENGINEERING MATERIALS
OPEN ELECTIVE-I

Pre requisites: Nil

Course Objectives:
1. To gain an knowledge about the uses and application of various ferrous metals and alloys.
2. To gain an knowledge about the uses and application of various non ferrous alloys.
3. To gain an knowledge about the uses and application of various ceramics, polymers and composites for different engineering applications.

Course Outcomes:
At the end of the course, student would be able to recommend
1. Ferrous metals and alloys for a given engineering applications and service condition.
2. Non ferrous alloys for a given engineering applications and service condition.
3. Ceramics, Polymers and composites for a given engineering applications and service condition.

UNIT-I
FERROUS ALLOYS: Introduction, Designations and classifications for steels, Simple Heat Treatments, Effect of Alloying Elements.

UNIT-II
NONFERROUS ALLOYS: Introduction, properties and applications, Aluminum Alloys, Magnesium Alloys, Copper Alloys and Titanium Alloys.

UNIT-III
CERAMIC MATERIALS: Introduction, Properties and Applications of Ceramics, Glasses and Refractories.

UNIT-IV
POLYMERS: Introduction, Classification of Polymers, Polymerization, Degree of Polymerization, Typical Thermoplastics and Thermosets.

UNIT-V
COMPOSITES: Introduction, Classification, Properties and Applications of Polymer matrix, Metal Matrix Ceramic Matrix and Laminar composites.

TEXT / REFERENCE BOOKS:
1. Donald R. Askland, Pradeep P. Phule, The Science and Engineering of Materials (4th Edition), Thomson Publishers, 2003.
2. William D. Callister Introduction to Material Science and Engineering, John Wiley and Sons, 2007.
3. W.F.Smith, Principles of Materials Science and Engineering, Mc Graw Hill, New York, 1994.

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METALLURGY FOR NON METALLURGISTS
OPEN ELECTIVE-I

Pre requisites: Nil

Course Objectives:
1. To describe the basic principles of metallurgy and the importance of metallurgy in various discipline of engineering.
2. Gain a thorough knowledge about heat treatment of steels.
3. Gain a knowledge about properties and uses of cast irons and non ferrous metals.
4. Gain a working knowledge of basic testing methods for metals.

Course Outcomes:
At the end of the course Student would be able
1. To use and apply metallurgy in his own branch of engineering.
2. The student will be able to justify the various testing methods adopted for metals.

UNIT-I
Introduction: Crystal structure and defects, Crystal structure of metals, Classification of steels, Carbon steels

UNIT-II
Heat Treatment of Steels: The Iron carbon systems, Common phases in steels, Annealing, Normalizing, Hardening and tempering

UNIT-III
Cast irons: Properties and applications of Ductile irons, Malleable irons, Compacted graphite iron.

UNIT-IV
Non Ferrous Metals: Properties and applications of Light Metals (Al , Be, Mg, Ti), Super alloys

UNIT-V
Testing of Metals: Hardness testing, Tensile Testing, Impact Testing, Fatigue Testing.

TEXT BOOKS
1. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007
2. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL ,1997
3. Metallurgy for Engineers- Clark and Varney
4. Mechanical Metallurgy – G. E. Dieter

REFERENCE BOOKS
1. Engineering Physical Metallurgy and Heat treatment – Y Lakhtin
2. C. Suryanarayana, Experimental Techniques in Mechanics and Materials, John Wiley, John Wiley, NJ, USA,2006
Foundations of Materials Science and Engineering – WF Smith

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INDUSTRIAL POLLUTION CONTROL ENGINEERING
OPEN ELECTIVE-I

Objective:
To expose the students to various types of industrial pollutions and controlling techniques.

OUTCOME:
The student will be able learn the sources of air, water pollution and also their treatment methods

UNIT-I
Introduction to industrial pollution and types of pollution from chemical industries, Effects of pollution as environment and ecosystems-global warming-green house effect; Environmental legislatures-standards and guidelines.

UNIT –II
Air pollution- Meteorological aspects of pollution dispersion-adiabatic lapse rate-Environmental lapse rate-Turbulence and stability of atmosphere, Richardson number-Plume raise-plume behavior and characteristics, effective stack height. Major air pollutants and their sources, measurement of air pollutants

UNIT -III
General methods of control air pollutants removal of sulphur dioxide, oxides of nitrogen and organic vapors from gaseous effluents; Removal of particulate matter – principle and working of setting chambers, cyclone separators, fabric and fibre filters – electro static precipitators, Treatment of gaseous effluents.

UNIT -IV
Introduction to water pollution – water pollutants classification – characteristics of liquid effluents from fertilizer, pulp & paper and petroleum industries, estimation of oxygen demands – DO, BOD, COD, TOC – BOD curves, oxygen sag curve – modeling of BOD curves
Biological treatment of waste waters – aerobic and anaerobic methods – suspended and attached growth processes – bacteria – Reproduction in bacterial – Bacterial growth crushes, conventional activated sludge process – Trickling filters, Aerated lagoons – stabilization ponds – fluidized bed contractors.

UNIT -V
Physical Treatment methods : Principle and working of screening – sedimentation – flotation – filtration – flocculation, Tertiary Treatment methods – carbon adsorption – Ion exchange – Reverse Osmosis, Boralin Chlorinating – Ultra filtration, Sludge treatment and disposal , removal of chromium and phenol from liquid effluents.
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Text books:
1. Pollution control in process industries by S.P. Mahajan TMH.,1985
2. Waste water treatment by M.Narayana Rao and A.K.Datta,Oxford and IHB publ. New Delhi

References:
1. Environmental pollution and control engineering by Rao C. S. – Wiley Eastern Limited, India, 1993.
2. Air pollution control by P.Prathap mouli and N.Venkata subbayya. Divya Jyothi Prakashan, Jodhpur.

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ESTIMATION, QUANTITY SURVEY & VALUATION
OPEN ELECTIVE -II

Pre Requisites:
Concrete Technology, RC Design, Desgin of Steel Structure

Course Objectives:
The subject provide process of estimations required for various work in construction. To have knowledge of using SOR & SSR for analysis of rates on various works .

Course Outcomes:
Able to provide control steps for disaster mitigation steps

UNIT – I
General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating.

UNIT – II
Detailed Estimates of Buildings - Reinforcement bar bending and bar requirement schedules

UNIT – III
Earthwork for roads and canals.

UNIT – IV
Rate Analysis – Working out data for various items of work over head and contigent charges.

UNIT-V
Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation -Standard specifications for different items of building construction.

NOTE : NUMBER OF EXERCISES PROPOSED :
1. Three in flat Roof & one in Sloped Roof
2. Exercises on Data – three Nos.

Text Books:
1. Estimating and Costing by B.N. Dutta, UBS publishers, 2000.
2. Estimating and Costing by G.S. Birdie

Reference books:
1. Standard Schedule of rates and standard data book by public works department.
2. I. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)
3. Estimation, Costing and Specifications by M. Chakraborthi; Laxmi publications.

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DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS
OPEN ELECTIVE-II

Pre-requisite: Power systems-I and Power Systems-II

Objectives:
Objectives of this course are
- To emphasize the estimating and costing aspects of all electrical equipment, installation and designs to analyze the cost viability.
- To design and estimation of wiring,
- To design overhead and underground distribution lines, substations and illumination design.

OUTCOMES:
Students are in a position to Understand the design considerations of electrical installations.
- To design electrical installation for buildings and small industries.
- To identify and design the various types of light sources for different applications.

UNIT - I
DESIGN CONSIDERATIONS OF ELECTRICAL INSTALLATIONS: Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections , Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT - II
ELECTRICAL INSTALLATION FOR DIFFERENT TYPES OF BUILDINGS AND SMALL INDUSTRIES: Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

UNIT - III
OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES: Introduction, Supports for transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.

UNIT - IV
SUBSTATIONS: Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

UNIT – V
DESIGN OF ILLUMINATION SCHEMES: Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, CFL and OCFL differences.

TEXT BOOKS
1. Electrical Design Estimating and Costing, K. B. Raina, S. K. BhattAcharya, New Age International Publisher.
2. Design of Electrical Installations, Er. V. K. Jain, Er. Amitabh Bajaj, University Science Press.

REFERENCE BOOKS

1. Code of practice for Electrical wiring installations,(System voltage not exceeding 650 volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution, IS: 4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032.
4. Code of Practice for selection, Installation of Maintenance of fuse (voltage not exceeding 650V), Indian Standard Institution, IS: 3106-1966.
5. Code of Practice for earthling, Indian Standard Institution, IS:3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian Standard Institution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650 Volts), Indian Standard Institution, IS: 2274-1963.
8. Electrical Installation, estimating and costing, Gupta J. B., Katson, Ludhiana.

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ENERGY STORAGE SYSTEMS
OPEN ELECTIVE-II

Pre-requisite: None

Objectives:
Objectives of this course are
- To enable the student to understand the need for energy storage, devices and technologies available and their applications.

OUTCOMES: After this course, the student
- Can analyze the characteristics of energy from various sources and need for storage
- Can classify various types of energy storage and various devices used for the purpose
- Can apply the same concepts to real time problems.

UNIT - I
Electrical Energy Storage Technologies: Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT - II
Needs for Electrical Energy Storage: Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT - III
Features of Energy Storage Systems: Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES), Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2), Synthetic natural gas (SNG).

UNIT - IV
Types of Electrical Energy Storage systems: Electrical storage systems, Double-layer capacitors (DLC) ,Superconducting magnetic energy storage (SMES),Thermal storage systems ,Standards for EES, Technical comparison of EES technologies.

UNIT - V
Applications: Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems , Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA– aggregation of many dispersed batteries.

TEXT BOOKS
1. Energy Storage Benefits and Market Analysis' by James M. Eyer, Joseph J. Iannucci and Garth P. Corey.
2. The Electrical Energy Storage by IEC Market Strategy Board.

REFERENCE BOOKS:
1. Jim Eyer, Garth Corey: Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

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MECHATRONICS
OPEN ELECTIVE-II

UNIT – I

INTRODUCTION: Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – II

PRECISION MECHANICAL SYSTEMS: Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.

ELECTRONIC INTERFACE SUBSYSTEMS: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resetable fuses, thermal dissipation - Power Supply - Bipolar transistors / MOSFETs

UNIT – III

ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming – Assembly, C (LED Blinking , Voltage measurement using ADC).

UNIT – IV

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input/output - PLC Selection - Application.

UNIT – V

PROGRAMMABLE MOTION CONTROLLERS: Introduction - System Transfer Function – Laplace transform and its application in analyzing differential equation of a control system - Feedback Devices: Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive, Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics by M.D.Singh, J.G.Joshi PHI.
3. Mechatronics HMT

REFERENCE BOOKS

1. "Designing Intelligent Machines". open University, London.
2. Michel B. Histand and David G. Alciatore,"
3. Introduction to Mechatronics and Measurement systems, "Tata MC Graw Hill
4. I. C.W. Desi ha, "Control sensors and actuators," Prentice Hall.
5. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
6. Mechatronics – N. Shanmugam / Anuradha Agencies Publisers.
7. Mechatronics System Design / Devdas shetty /Richard / Thomson.

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JET PROPULSION AND ROCKET ENGINEERING
OPEN ELECTIVE-II

Prerequites: None

Course outcomes:
After doing this course, student should be in position to
1. Understand Turbo Jet Propulsion System
2. Analyze the flight performance
3. Understand Principles of Jet Propulsion and Rocketry & Nozzle Theory and Characteristics
4. Learn the Aero thermo chemistry of the combustion products
5. Understand the physics of Solid propellant rocket engine, Liquid Rocket Propulsion System & Ramjet and Integral Rocket Ramjet Propulsion System**:**

Unit - I:
Turbo Jet Propulsion System:
Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery- compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis.
Flight Performance:
Forces acting on vehicle – Basic relations of motion – multi stage vehicles.

Unit - II:
Principles of Jet Propulsion and Rocketry:
Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet , turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.
Nozzle Theory and Characteristics Parameters:
Theory of one dimensional convergent – divergent nozzles – aerodynamic choking of nozzles and mass flow through a nozzle – nozzle exhaust velocity – thrust, thrust coefficient, A_c / A_t of a nozzle, Supersonic nozzle shape, non-adapted nozzles, summer field criteria, departure from simple analysis – characteristic parameters – 1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

Unit - III: Aero Thermo Chemistry of The Combustion Products:
Review of properties of mixture of gases – Gibbs – Dalton laws – Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation – calculation of adiabatic flame temperature and specific impulse – frozen and equilibrium flows.
Solid Propulsion System:
Solid propellants – classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.

Unit - IV:
Solid propellant rocket engine – internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices.
Liquid Rocket Propulsion System:
Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors – various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

Unit - V: Ramjet and Integral Rocket Ramjet Propulsion System:
Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and sub-critical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.

TEXT BOOKS:
1. Gas Turbines and propulsive systems-P.Khajuria& S.P.Dubey/Dhanpatrai pub.
2. Gas Dynamics & Space Propulsion M.C.Ramaswamy / Jaico Publishing House.

REFERENCE BOOKS:
1. Rocket propulsion –Sutton
2. Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.
3. Gas Turbines-V.Ganesan /TMH.

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ERGONOMICS
OPEN ELECTIVE-II

Prerequists: None

Objectives:
Provide a broad based introduction to ergonomic principles and their application in the design of work, equipment and the workplace. Consideration is given to musculo-skeletal disorders, manual handling, ergonomic aspects of the environment as well as to the social and legal aspects.

Course Outcomes:
On completing this course successfully the student will be able to:
- understand and apply ergonomic principles to the creation of safer, healthier and more efficient and effective activities in the workplace;
- understand ergonomic risk assessments and appropriate control measures;
- understand the causes of upper limb disorders and how to reduce them;
- appreciate workplace layout and equipment design;
- appreciate environmental aspects of good ergonomic design.

UNIT I
Introduction to Ergonomics, Human, Machine Systems, Basic Work Systems, Human Relations and Occupational Psychology, Hawthrone Experiments, Participation, Occupational Medicine, Human Performance Psychology, FMJ versus FJM, Human Factors and Ergonomics. Modern Work Systems and Neo, Taylorism, Attempts to Humanize Work, Generic Tools in Ergonomics, Effectiveness and Cost Effectiveness of Ergonomics in General.

UNIT II
Design and Evaluation of Manual Handing Tasks, Anatomy and Biomechanics of Manual Handling, Prevention of Manual Handling Injuries in the Workplace, Design of Manual Handling Tasks.
Body Mechanics at Work: Risk Assessment and Design, Low Back Pain, Biomechanics of Spinal Loading, Ergonomics and Musculoskeletal System in General, Effectiveness and Cost Effectiveness.

UNIT III
Physically Demanding Work: Stress and Fatigue, Physically and Psychologically Demanding Work, Muscles, Structure and Function, and Capacity, Physical work capacity.
User, Cantered Workspace Design Anthropometric Data, Statistical Essentials, Types of Anthropometric Data, Applications Of Anthropometry in Design, Multiple Workspace Configurations, Status of Anthropometry in Ergonomics.

UNIT IV
Human Error, Accidents, and Safety, Micro ergonomics, Human Error, and Accidents, Prevention of Error in Human, Machine Interaction, Macroergonomices: Performance Shaping Factors.

UNIT V
Visual Environment: Measurements and Design, Vision and the Eye, Measurement of Light, Lighting Design Considerations, Visual figure, Eyestrain, and Near Work, Status of Methods in Risk Assessment and Task design.
Hearing, Sound, Noise and Vibration, Measurement of Sound, Hearing Protection, Design of Acoustic Environment.

Text books
1. Introduction to Ergonomics(Third Edition)/ R.S.Bridger/CRC Press , Taylor & Francis Group

References
1. Human factors in Engineering and Design/E.J.McCormick/ TMH Edison
2. Motion and Time Design and Measurement of work/ Barnes Ralph., / John Wiley & sons Newyork, 2002

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MECHATRONICS
OPEN ELECTIVE-II

Pre-requisites: None.

Course objectives:
- They should be able to link up mechanical and electronics.

Outcomes:
- Develop a relationship between mechanical elements and electronics elements for proper functioning of mechanical systems.

UNIT – I
INTRODUCTION: Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM.

SIGNAL CONDITIONING : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution, Filtering Noise using passive components – Registors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – II
PRECISION MECHANICAL SYSTEMS :
Modern CNC Machines – Design aspects in machine structures, guideways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring.
Note: (text book: Mechatronics HMT – chapter 5)

ELECTRONIC INTERFACE SUBSYSTEMS : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT – III
ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.
MICROCONTROLLERS OVERVIEW : 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking , Voltage measurement using ADC).

UNIT – IV
PROGRAMMABLE LOGIC CONTROLLERS : Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT – V
PROGRAMMABLE MOTION CONTROLLERS : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

TEXT BOOKS :

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCE:

1 “Designing Intelligent Machines”. open University, London.
2 Michel B. Histand and David G. Alciatore,”
3 Introduction to Mechatronics and Measurement systems, “Tata MC Graw hill
4 I. C.W. Desi ha, “Control sensors and actuators,” Prentice Hall.
5 Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
6 Mechatronics – N. Shanmugam / Anuradha Agencies Publisers.
Mechatronics System Design / Devdas shetty/Richard/Thomson.

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PRINCIPLES OF ELECTRONIC COMMUNICATIONS
OPEN ELECTIVE-II

Prerequsite : Nil

Course Objectives:
The objective of this subject is to:
- Introduce the students to modulation and various analog and digital modulation schemes.
- They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes:
By completing this subject, the student can
- Work on various types of modulations.
- Should be able to use these communication modules in implementation.
- Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

Unit 1:
Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.

Unit 2:
Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

Unit 3:
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.

Unit 4:
Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

Unit 5:
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, WCDMA.
Wireless Technologies: Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books:
1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Kennady, Davis, Electronic Communications systems, 4e, TMH, 1999

Reference Books:
1. Tarmo Anttalainen, Introduction to Telecommunications Network Engineering, Artech House Telecommunications Library.
2. Theodore Rappaport, Wireless Communications-Principles and practice, Printice Hall, 2002.
3. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
4. Wayne Tomasi, Introduction to data communications and networking, Pearson Education, 2005.

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CYBER SECURITY
OPEN ELECTIVE -II

Prerequisites
1. A Course on "Network Security and Cryptography"

Objectives
1. The purpose of the course is to educate on cyber security and the legal perspectives of cyber crimes and cyber offenses.
2. Introduce tools and methods for enhancing cyber security.
3. Topics include- cyber crimes, cyber offenses, cyber crimes on mobile and wireless devices, tools and methods to prevent cyber crimes, legal perspectives of cyber crimes and cyber security, computer forensics, Intellectual Property Rights and cyber terrorism

Outcomes
1. Demonstrate the knowledge of cyber security and understand the Indian and Global Act concerning cyber crimes
2. Employ security and privacy methods in the development of modern applications such that personal data is protected; and provide safe Internet usage.

UNIT-I
Introduction to Cybercrime:
Introduction, Cybercrime and Information security, who are cyber criminals, Classification of Cyber crimes, Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cyber crimes.
Cyber offenses : How Criminals Plan Them
Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT-II
Cybercrime: Mobile and Wireless Devices
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.
Tools and Methods Used in Cyber Crime:
Introduction, Proxy services and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

UNIT III
Cyber crimes and Cyber Security: the Legal Perspectives Introduction
Cyber Crime and Legal Landscape around the world, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario In India, Digital signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment Cyber law, Technology and Students: Indian Scenario.

Understanding Computer Forensics
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody concept, Network Forensics, Approaching a computer, Forensics Investigation, Challenges in Computer Forensics, Special Tools and Techniques Forensics Auditing

UNIT IV

Cyber Security: Organizational Implications

Introduction, cost of cyber crimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cyber crimes the psychology, mindset and skills of hackers and other cyber criminals

UNIT V

Cybercrime: Illustrations, Examples and Mini-Cases

Examples:

Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases:

The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Illustrations of Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios.

Text book:

1. **Cyber Security**: *Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference book:

1. **Cyber Security Essentials**, James Graham, Richard Howard and Ryan Otson, CRC Press.

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DATABASE MANAGEMENT SYSTEMS
OPEN ELECTIVE-II

Prerequisites
1. A course on "Advanced Data Structures"

Objectives
1. To understand the basic concepts and the applications of database systems.
2. To master the basics of SQL and construct queries using SQL.
3. Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Outcomes
1. Gain knowledge of fundamentals of DBMS, database design and normal forms
2. Master the basics of SQL for retrieval and management of data.
3. Be acquainted with the basics of transaction processing and concurrency control.
4. Familiarity with database storage structures and access techniques

UNIT I:
Database System Applications: database system Vs. file system, view of data, data abstraction, instances and schemas, data models, the ER model, relational model, other models, database languages, DDL, DML, database access for application programs, database users and administrator, transaction management, database system structure, storage manager, the query processor, history of data base systems, data base design and ER diagrams, beyond ER design entities, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER Model, conceptual design for large enterprises.

UNIT II:
Introduction to the Relational Model: integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying/altering tables and views, form of basic SQL query, examples of basic SQL queries, introduction to nested queries, correlated nested queries, set comparison operators, aggregation operators, NULL values, comparison using null values, logical connectivity's, AND, OR and NOT, impact on SQL constructs, outer joins, disallowing NULL values, complex integrity constraints in SQL, triggers and active data bases, Oracle, SQL Server, DB2.

UNIT III:
Relational Algebra: Selection and projection, set operations, renaming, Joins, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus.
Schema refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, dependency preserving decomposition, schema refinement in database design, multi valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT IV:
Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity. Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with loss of nonvolatile storage, Advance Recovery systems, Remote Backup systems.

UNIT V:
Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning, Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

Text Books:
1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill 3rd Edition
2. Database System Concepts, Silberschatz, Korth, Mc Graw hill, V edition.

References:
1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J. Date Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL,Shah,PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

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CORROSION ENGINEERING
OPEN ELECTIVE-II

Pre-requisites: NIL

Course Objectives:
1. To demonstrate electrometallurgy principles in deposition winning and the efficiency of the bath.
2. To determine corrosion rate/ resistance of metals and alloys.
3. To explain corrosion protection methods and tests.

Course Outcomes:
At the end of the course the student will be able:
1. To gain knowledge in various types of electrolytic cells and the processes taking place in them.
2. To obtain knowledge about the importance of controlling corrosion and its prevention measures.
3. The course is useful for higher studies, R&D, and also for getting into jobs in industries.

UNIT - I
Introduction, Electro Chemistry principles, electrochemical reactions, Polarization, passivity, environmental effects (oxygen, oxidizers, velocity, temperature, corrosive concentration, Galvanic coupling).

UNIT - II
Corrosion, Introduction, Definition, classification, Forms of corrosion, uniform corrosion,
Two metal corrosion: Sacrificial anode, EMF and Galvanic Series, Environmental effects,
Pitting corrosion: Pit shape and growth, Autocatalytic Nature of pitting, Crevice corrosion.

UNIT - III
Intergranular corrosion: Sensitization, weld decay, Knife-Line attack, Stress corrosion cracking: crack morphology, stress effects, environmental factors, metallurgical factors, Erosion corrosion: cavitation damage, fretting corrosion, Corrosion fatigue.

UNIT - IV
Corrosion prevention methods: Alteration of Environment (Inhibitors), Design, Coatings, cathodic and anodic protection. Material selection, Metallurgical aspects, Hydrogen damage (hydrogen blistering, Hydrogen embrittlement, Prevention).

UNIT - V
Modern theory and applications of corrosion: Introduction, free energy, cell potentials, emf series, applications of thermodynamics to corrosion, Corrosion rate expressions and measurements, corrosion testing.

Text / Reference Books:
1. Theory of Corrosion and Protection of Metals, N. D. Tomashov, Macmillan, 1967.
2. Corrosion Engineering, M. G. Fontana, 3rd edition, McGraw-Hill, 1985.
3. Corrosion and Corrosion Control, H. H. Uhlig, Wiley, 1985.

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TESTING OF MATERIALS
OPEN ELECTIVE-II

Pre-requisites: NIL

Course Objectives:
1. To gain and understanding of the response of various metals under the application of stress and/or temperature.
2. To build necessary theoretical back ground of the role of lattice defects in governing bot;h elastic and plastic properties of metals will be discussed.
3. Obtain a working knowledge of various hardness testing machines BHN, VHN, RHN
4. Obtain a working knowledge of creep and fatigue and analysis of data.

Course Outcomes:
At the end of the course the student will be able to:
1. Classify mechanical testing of ferrous and non-ferrous metals and alloys.
2. Recognize the importance of crystal defects including dislocations in plastic deformation.
3. Identify the testing methods for obtaining strength and hardness.
4. Examine the mechanisms of materials failure through fatigue and creep

UNIT – I
Introduction, Importance of testing
Hardness Test: Methods of hardness testing – Brinell, Vickers, Rockwell hardness tests.
The Impact Test: Notched bar impact test and its significance, Charpy and Izod Tests, fracture toughness testing - COD and CTOD tests, significance of transition temperature curve.

UNIT - II
The Tension Test: Engineering stress-strain and True stress-strain curves. Tensile properties, conditions for necking. Stress-Strain diagrams for steel, Aluminum and cast iron.

UNIT - III
Fatigue Test: Introduction, Stress cycles, S-N Curve, Effect of mean stress, Mechanism of fatigue failure, Effect of stress concentration, size, surface condition and environments on fatigue.

UNIT – IV
Creep and Stress Rupture: Introduction, The creep curve, Stress-rupture test, Structural changes during creep, Mechanism of creep deformation, theories of creep. Fracture at elevated temperature.

UNIT – V
NDT: Principle, Operation, Advantages and Limitations of Liquid Penetrant, Magnetic Particle, Radio graphy and Ultrasonic tests.

TEXT / REFERENCE BOOKS:
1. Mechanical Metallurgy – G. E. Dieter
2. Mechanical behavior - Ed. Wulf.
3. Mechanical Metallurgy – White & Lemay.
4. Testing of Materials - A.V.K. Suryanarayana

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SOLID WASTE MANAGEMENT
OPEN ELECTIVE-II

Objectives:
- To know the Classification of solid waste and characterization of the same
- Understand the sense of onsite handling storage and collection systems including transportation
- Understand the different processing technologies of solid waste.

Outcomes:
The student will be able to
- Apply the knowledge of characterization of waste and develop a suitable management plan
- Assess the cost of transportation and laboratory processing of solid waste
- Identify hazardous nature of waste if any and can suggest suitable dumping methods.
- Suggest processing waste for material for energy recovery.

Unit I
Introduction: Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics. Variation of composition and characteristics. Municipal, industrial, special and hazardous wastes.

General aspects: Overview of material flow in society. Reduction in raw material usage. Reduction in solid waste generation. Reuse and material recovery. General effects on health and environment. Legislations.

Unit II
Engineered systems: Typical generation rates.Estimation and factors effecting generation rates. On site handling.Storage and processing. Collection systems and devices. Transfer and transport.

Unit III
Processing Techniques: Mechanical volume reduction. Thermal volume reduction. Component separation. Land filling and land forming. Deep well injection.

Unit IV
Material recovery: Mechanical size alteration. Electromagnetic separation. Drying and dewatering. Other material recovery systems. Recovery of biological conversion products. Recovery of thermal conversion products.
Energy recovery: Energy recovery systems and efficiency factors. Determination of output and efficiency. Details of energy recovery systems. Combustion incineration and heat recovery. Gasification and pyrolysis. Refuse derived fuels (RDF).

Unit V
Case studies: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.

Text Books:
1. Howard S. Peavy, Environmental Engineering, McGraw Hill International Edition, 1986.
2. Dutta, Industrial Solid Water Management and Land Filling Practice, Narose Publishing House, 1999.

Reference Books:
1. Sastry C.A., Waste Treatment Plants, Narose Publishing House, 1995.
2. Lagrega, Hazardous Waste Management, McGraw Hill, 1994.

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MARKETING MANAGEMENT
PG CORE-I

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim: The aim of the Marketing Management Course is to provide students the marketing skills and enable them .

- T o understand the basic marketing trends through case studies.
- To familiarise with basic concepts of marketing mix and strategies
- To get oriented to the tools required to help develop and implement marketing strategies.

Learning outcome:

The students would be able to describe key marketing concepts, theories and techniques for analyzing a variety of marketing situations

By reading text and relating the concepts through cases the student would be able to understand the importance and role of marketing in a global environment

They will be able to analyze markets and design customer driven strategies and will be able to communicate the decisions towards business development with superior customer value.

1. Introduction to World of Marketing: Importance, scope of Marketing, Core Marketing Concepts, Marketing Philosophies, Marketing Environment, Marketing Strategies & Plans, Developed Vs Developing Marketing. Market Research-Definition of MR, MIS, Commissioning MR, MR Process, MR Online, MR & Ethics, International MR.
   Case 1: Bata (Rajendra.P Maheshwari page no: 03)
   Case 2: Mahindra Scooters (Arun Kumar page no: 89).
   Case 3: Ready Meal Manufactures (Adrian palmer, page no: 70).
   Case 4: Santoor –(lamb Hair– page no : 238).
   Case 5: Drawing on data, searching for insight (Adrian palmer – Page no: 175).

2. Analyzing Marketing Opportunities, Customer Value and Marketing Mix : Consumer Decision Making, Creating Customer Value, Analyzing Consumer Markets – Consumer Behavior – cultural, Social & Personal Factors, developing products & brands – product levels; classifying products, product range, line & mix, PLC, new product development.
   Case 1: Small New Phones (Adrian palmer- page no: 296).

3. Designing a Customer Driven Strategy: Market segmentation- segmentation of consumer market, business market, requirement for effective segmentation, market targeting – evaluating market segmentation, selecting target market segmentation, positioning – positioning maps, positioning strategy.
   Case 1: (Segmentation) Zee TV (lamb, Hair page no 212).
   Case 2: (Targeting) Kellogg's (lamb, Hair page no 300)
   Case 3: (Positioning) Nimbooz (S. Neelamegham page no 225).
   Case 4 :(Positioning) Dalda (Arun Kumar page no:195).

4. Distribution Decisions, Promotion & Communication Strategies : Marketing Channels, Channel intermediates and functions, channel structure, channel for consumer products, business and industrial products, alternative channel, channel strategy decisions. The promotional mix, advertising, public relations, sales promotion, personal selling, marketing communication- communication process, communication promotion mix, factors effecting the promotion mix
   Case 1: Barista (Arun Kumar – page no:33).
   Case 2: Nano Car (lamb, Hair – page no:52)
   Case 3: Indigo (lamb, Hair – page no:356).
   Case 4: TESCO (Adrian palmer page no : 388)
   Case 5: Hero Motor Corp (lamb, Hair Page no:446)
   Case 6: Avon Cosmetics (lamb, Hair Page no:497).
   Case 7: Eureka (Arun – Page no: 711).
   Case 8: Home Shop (Arun – page no: 639).

5. Pricing Decisions & Personal Communication - Importance of price, cost determinant of price, markup pricing, profit maximization pricing, break even pricing, pricing strategy, ethics of pricing strategy, product line pricing, WOM, Rural marketing, BOP, relationship Marketing, Digital marketing, Social marketing, post modern marketing, market sustainability and ethics, Global marketing.
   Case 1: Coca Cola(lamb, Hair – page no: 112).
   Case 2: I phone (lamb, Hair – page no: 534).
   Case 3: Akash Tablet (lamb, Hair – page no: 557).
   Case 4: Compact car (Arun Kumar page no :369)
   Case 5: Chick (lamb,Hair Page no:650)
   Case 6: Nokia (Neelamegham page no– 645).
   Case 7: Shakti (Rajendra .P Maheswari – Page no:408).
   Case 8: Airtel (Arun – page no: 901)
   Case 9: Beer Marketing (Adrian palmer page no:529)

Textbook:

1. Lamb, Hair, Sharma, Mc Daniel: MKTG, A South Asian Perspective, Cengage Learning, 2012.
   Journal : MICA Communications Review – A Marketing Communications Journal, Mudra Institute of Communications, Ahmedabad.
   Business Game
   Music2Go Marketing: (Marketing Management Simulation Game), TMH, 2013. You can play on any computer with internet (Rs.150/- per year-better buy and play).

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HUMAN RESOURCE MANAGEMENT
PG CORE-II

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
To understand various terms in HRM and be able to manage the human resources of an organization effectively and efficiently.

Learning Outcome:
Students should be able to understand the basic HR concepts. They will be able to understand the process of recruitment, selection, performance appraisal, training & development, compensation and employee retention approaches and strategies.

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Unit-I:
Introduction of HRM: Introduction to HRM –Line Managers –HR Duties –New Approaches to Organizing HR –Globalization & Competition Trends Technological Trends –Trends in Nature of Work –Workforce and Demographic Trends –Economic Challenges –HRM in India –High Performance Work System's–Labor Legislation in India –Equal Employment Opportunity 1990-1991 –HR Score Card developed by TVRLS India.

Case: Social Surveyors in Flood-hit Areas (Gary Dessler page no 160)
Case: Finding people who are passionate about what they do (Gary Desslerpage no 195)
Case: HR, CULTURE and Business Results Success at Google, Scripps and UPS (Robert L Mathis P.No. 35)
Case: Religious Accommodation (Robert L Mathis P. No. 118)
Case: Mitsubishi Believes in EEO-Now (Robert L Mathis P. No. 119)

Unit-II: Recruitment and Placement: Basics of Job Analysis –Methods for Collecting Job Analysis Information –Job Descriptions –Job Satisfaction –Job Enlargement, Job Enrichment, Job Rotation, HRP –Recruitment & Selection Process –Planning & Forecasting –Sources of Recruitment –Recruitment of Diverse Work Force –Employee Testing & Selection –Basic types of Interviews –Errors in Interviews –Translating Strategy into HR-Policies & Practices.

Case:Reinventing the wheel at apex door Company (Gary Dessler page no 309)
Case: Xerox Focuses on HR (Robert L Mathis P. No. 79)
Case: where do you find the Bodies? (Robert L Mathis P. No. 79)
Case: The Reluctant Receptionist (Robert L Mathis P. No. 159)
Case: Accenture –Retaining for Itself (Robert L Mathis P. No.193)
Case: Recruiting at Kia (Robert L Mathis P. No. 231)
Case: Strategic Selection: A Review of Two Companies (Robert L Mathis P. No.267)

Unit-III:
Performance Appraisal and Training & Development of Employees –Concept of Performance, Management Appraisal –Techniques for Performance Appraisal –Career Management –Employer Life Cycle –Career Management & Talent Management, Analyzing Training needs & Designing the program –Implementing different training program –Implementing Management Development Programs –Evaluating the Training Programs .

Case: Training Crucial for Hotels (Robert L Mathis P. No. 307)
Case: performance management improvements for Bristol-Myers Squibb (Robert L Mathis P. No. 393)
Case: Just Another Job (Robert L Mathis P. No. 647)
Case: The Dilemma Within (Robert L Mathis P. No. 667)
Case: Performance Appraisal at Cola Magic Drinks (Robert L Mathis P. No. 671)
Case: Appraising the secretaries at Sweet water U? (Gary Dessler page no 349)

Unit-IV: Compensation–Basic Factors in Determining pay structure –Establishing pay rates –Pricing Managerial and Professional Jobs –Special Topics in Compensation –Benefits –Insurance –Retirement Benefits –Personal Services & Family friendly benefits –Salient features of Workmen Compensation Act & Minimum Wages Act.

Case: Salary inequities at ACME Manufacturing (Gary Dessler page no 429)
Case: HR Contributes at CSSCO (Robert L Mathis P. No. 36)
Case: Compensation changes at JC Penny (Robert L Mathis P. No. 435)
Case: Benefiting Connie (Robert L Mathis P. No. 507)

Unit-V: Employee Relation–Labour Movement –Collective Bargaining Process –Grievances –Managing Dismissals –Employee Safety and Health –Occupational Safety Law –Work Place Health Hazards Problems & Remedies –Salient features of Industrial Disputes Acts 1947 –Factories Act, Mines Act.

Case : The New Safety and Health Program (Gary Dessler page no 623)
Case : Full Disclosure on Sex Offenders? (Robert L Mathis P. No. 231)
Case : Wal-Mart and Watching Its “Union Prevention” (Robert L Mathis P. No. 629)

REFERENCES:

- Gary Dessler, “Human Resource Management”, 12thEdition, Pearson-2012.
- Robert L Mathis, John H Jackson, Manas Ranjan Tripathy “Human Resource Management-A South Asian Perspective ”, Cengage Learning2012.
- C.B.Mamoria & V.S.P.Rao, Personnel Management, HPH, 2012.
- K. Aswathappa, “Human Resource Management, Text and Cases”, TMH, 2011.
- Dipak Kumar Bhattacharyya “Human Resource Management”, Excel Books, 2012.
- R.Wayne Mondy, “Human Resource Management” Pearson, 2009

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SALES AND DISTRIBUTION

PG Elective-I (Marketing)

(Students must read textbook. Faculty are free to choose any other cases)

Aim: The aim of this course is to enable students to the sales and distribution processes with particular focus on Sales Management and Sales Personnel, the role of Distribution Channels and enabling them to manage Channel partners.

To expose students to the tools and strategies necessary for designing, motivating and evaluating sales & distribution management systems.

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Learning outcomes:

- The student should be able to manage the sales force and distribution processes through sales planning and Budgeting .
- The Students should be able to understand & appreciate the diverse variables affecting the sales & distribution function and analyse their impact on the sales and distribution processes.

1. **Introduction to Sales Management:** Evolution of Sales Management, importance of Sales Management, types of Selling, difference between Selling and Marketing, Modern Day Sales Activities, Selling Skills, Selling Strategies, Selling Process.
   Case: Plastic Industries, Inc., The role of Personal Selling in creating Market. (Richard R.Still page no 104,105)
   Case: United air flow manufacturer of households appliances sales persons job. (Richard R.Still page no 115 to 118)

2. **Sales Planning and Budgeting:** Sales planning process, sales forecasting methods, sales budgeting process, methods used for deciding sales budget, types of quotas and quota setting procedure, reasons for establishing or revising sales territories, routing and scheduling sales persons, market cost analysis.
   Case: Augsberg Wiesel Ltd, manufacturer of table ware, establishment of sales territories (Richard R Still, Page no 603 to 605)
   Case: Midland office engineering, establishment of sales budgeting program, (Richard R Still, page no 588 to 589)

3. **Sales Force Management:** Recruitment and selection of the sales force, training the sales force, sales force motivation, sales force compensation, sales force control and evaluation.
   Case: 1 Adjusting Compensation Plan to Motivate Sales Representatives (K.Sridhara Batt, page no 576 to 577)
   Case: 2 Sales Force Strategy at Life Insurance Corporation (K.Sridhara Batt, page no 579)

4. **Introduction to Distribution Management**
   Definition of Distribution Management, need for Distribution Channels, Distribution Channels for Rural Markets, designing the Marketing Channels, Motivating and Evaluating Channel Members, Capturing the Customer requirements
   Case: 1 Fed Ex's Value Chain Solutions, (K.Sridhara Batt page no 618 to 620)
   Case: 2 The National Handloom Development Corporation. (Tapan K. Panda, Sunil Sahadev page no. 504)

5. Managing Channel Institutions

Managing Channel Information Systems, Managing Retailers, Wholesalers, Franchisers, Designing Channel Systems, reasons for Channel Conflicts, Managing Conflict, Managing International Channel of Distribution, Ethical issues in Sales and Distribution Management

Case: 1 Kinetic Engineering Company, Handling Channel Conflict, (Krishna K Havaldar, Vasant page no 461)

Case: 2 Indian Ayurveda Pharmacy Limited, (Tapan K. Panda,Sunil Sahad page no 719)

Textbook

Krishna K Havaldar, Vasnt M Cavale, Sales and Distribution Management, 2nd edition, TMH, 2011.

Journal : MICA Communications Review – A Marketing Communications Journal, Mudra Institute of Communications, Ahmedabad.

Business Game : Music2Go Marketing: (Marketing Management Simulation Game), TMH, 2013. You can play on any computer with internet (Rs.150/- per year-better buy and play)**.**

Music2Go is a **Principles of Marketing/Marketing Management** simulation game, where the students are required to formulate and implement their own Sales and Marketing Campaign. This helps the students to have a hands – on business experience in the classroom – experiential learning at its best.

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TRAINING & DEVELOPMENT
PG Elective – I (HR)

(Students must read textbook. Faculty are free to choose any other cases)

Course Objectives:
1. To provide the students information on the Career opportunities in training, important concepts and meanings, Integrating strategy and training.
2. To enable the students to understand the design of training, implementation
3. To introduce the knowledge of evaluation of training programs in the organization.

Learning Outcome:
1. The student will be familiar with how to do training need analysis
2. Students will be able to learn various training methods, design training programs, implement training programs.
3. They also gain the knowledge to evaluate the effectiveness of training programs.

1. **Training in organizations:** Trends in training, Career opportunities in training, important concepts and meanings, Integrating OD, strategy and training, understand motivation and performance, aligning training design with learning process.
   Case : Taking Charge at Domtar : What it takes for a turnaround? (Nick Blanchard)
   Case :LG Electronics ((Nick Blanchard)
   Case : The wilderness training lab((Nick Blanchard)

2. **Need Analysis and Training design:** The Training Need Analysis (TNA) Model, TNA and Design, organizational constraints, developing objectives, Facilitation of learning and training transfer to the job, design theory.
   Case : Developing a training package at westcan (Nick Blanchard)
   Case : The Training program (Fabrics Inc.) (Nick Blanchard)

3. **Training methods:** Matching methods with outcomes, lectures and demonstrations , games and simulations, OJT, computer based training.(CBT).
   Case : Training & Development at Godrej. (Nick Blanchard)

4. **Implementation & Evaluation of Training:** Development of training, implementation, transfer of training, major players in training & development, rational for evaluation, resistance to training evaluation, types of evaluation.
   Case : Jack goes to training. (Nick Blanchard)
   Case 3 : Training designed to change behavior and attitude. (Nick Blanchard)

5. **Areas of organizational Training:** Orientation training, diversity training, sexual harassment training, team training, cross functional teams, cross cultural training, training for talent management and competency mapping.
   Case 4: The competent employee. (Nick Blanchard)

Textbook:
- **P.Nick Blanchard, James W. Thacker, A.Anand Ram, " Effective Training" 4e, Pearson, 2012.**

References:
1. Anjali Ghansekar "Training & Development" Everest, 2013.
2. Raymond A Noe, Amitabh Deo Kodwani, "Employee Training and Development" McGraw Hill, 2012.
3. B,Rathan Reddy " Effective Human Resource Training & Developing Strategy " Himalaya,2012 .
4. Rolf Lynton, Uday Pareek "Training for Development" Sage, 2012.
5. G Pandu Naik "Training & Development "Excel Books, 2012.
6. R K Sahu "Training for Development" Excel Books, 2012.
7. P L Rao : HRD Trainer's Handbook of Management Games, Excel, 2013

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FINANCIAL MANAGEMENT
PG Elective-I (Finance)

(Students must read textbook. Faculty are free to choose any other cases)
***The students need Discounting Table and Annuity tables for the examination**

Course Aim: To give an overview of the functions of a financial manager in the commercial world with a particular focus on the concepts and theories of corporate finance.

Learning Outcome:
The students will gain skills to understand, evaluate and resolve the problems confronted by the financial managers. They will gain in insight into the decision making process of a financial manager based on timely, relevant and reliable financial and non-financial information. This course will further help the students to understand the deligent use of resources efficiently, effectively and economically.

1 **The Finance Function**: Nature and Scope; Evolution of finance function – Its new role in the contemporary scenario –Goals of finance function – maximizing vs. satisfying; Profit vs. Wealth vs. Welfare; the Agency relationship and costs; Risk-Return trade off; Concept of Time Value of Money – Future Value and Present value and the basic valuation model.

2. **The Investment Decision**: Investment decision process- Project generation, project evaluation, project selection and project Implementation. Developing Cash Flow; Data for New Projects; Capital Budgeting Techniques –Traditional and DCF methods. The NPV vs. IRR Debate; Approaches for reconciliation. Capital budgeting decision under conditions of risk and uncertainty. Cost of capital: Concept and measurement of cost of capital, Debt vs. Equity, cost of equity, preference shares, equity capital and retained earnings, weighted average cost of capital and marginal cost of capital. Importance of cost of capital in capital budgeting decisions.

3. **Capital Structure Decisions**: Capital structure vs. financial structure - Capitalization, financial leverage, operating leverage and composite leverage. EBIT-EPS Analysis, Indifference Point/Break even analysis of financial leverage, Capital structure Theories –The Modigliani Miller Theory, NI, NOI Theory and Traditional Theory –A critical appraisal.

4. **Dividend Decisions**: Dividends and value of the firm - Relevance of dividends, the MM hypothesis, Factors determining Dividend Policy-dividends and valuation of the firm-the basic models. Declaration and payment of dividends. Bonus shares. Rights issue, share-splits, Major forms of dividends – Cash and Bonus shares. The theoretical backdrop – Dividends and valuation; Major theories centered on the works of GORDON, WALTER and LITNER. A brief discussion on dividend policies of Indian companies. Working Capital Management: Components of working capital, gross vs. net working capital, determinants of working capital needs, the operating cycle approach. Planning of working capital, Financing of working capital through Bank finance and Trade Credit – Recommendations of Tandon and Daheja Committee on Working Capital. Cases.

5. **Management of Current Assets**: Management of cash, – Basic strategies for cash management, cash budget, cash management techniques/processes. Marketable securities: characteristics, selection criterion, Marketable security alternatives; Management of receivables and Management of inventory- The importance of current assets management in working capital planning. Corporate Restructuring: Corporate Mergers, Acquisitions and Takeovers: Types of Mergers, Economic rationale of Mergers, motives for Mergers; Financial evaluation of Mergers.

Textbook

1. IM Pandey, Financial Management, 10th Edition, Vikas , 2013.

References:

1. M.Y Khan, P K Jain: “Financial Management-Text and Problems”, 6th Edition, TMH, 2012.
2. P.C.Tulsian,C.A. Bharat Tulsian , “Financial Management” S.Chand Publications,2012
3. Prasanna Chandra, “Financial Management Theory and Practice”, 8th Edition. TMH ,2012
4. Shashi K.Gupta, R.K.Sharma , “Financial Management” Kalyani Publishers ,2012
5. Rajiv Srivastava, Anil Mishra , Financial Management” Oxford University Press, New Delhi, 2012
6. James C Van Horne, Sanjay Dhamija, “Financial Management and Policy” Pearson Education, 2012 .
7. IM Pandey, Cases in Financial Management, TMH 2/e 2012

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MANAGEMENT INFORMATION SYSTEM (MIS)
PG Elective – I (SYSTEMS)

Course Objectives
1. To provide students basic concepts of MIS and IS models
2. To explain integration process of MIS with Enterprise Resource Planning (ERP)
3. To provide a practical framework for Information System operations and management

Learning Outcomes
1. Students learn different models of MIS and their applicability in various business resource requirement plans
2. Students learn user training, operations, control, troubleshooting and maintenance aspects of MIS
3. Students will appreciate what is the successful design and implementation of MIS in business departments and operations

1. UNIT- I Introduction to IS Models – Nolan Stage Hypothesis, IS Strategic Grid, Wards Model, Earl's Multiple Methodology, Critical Success Factors, Soft Systems Methodology, Socio-Technical Systems Approach (Mumford), System Develop Life Cycle, Prototype and End User Computing, Application Packages, Outsourcing, Deciding Combination of Methods.

2. UNIT-II Types of Information Systems– Transactions Processing System, Knowledge Work Systems, Office Automation System, Management Information System, Decision Support System, Expert System, Strategic Information System. IS Security, Control and Audit - System Vulnerability and Abuse, business value of security and control, Need for Security, Methods of minimizing risks, IS Audit, ensuring system quality.

3. UNIT- III Induction to ERP**:** Overview of ERP, MRP, MRPII and Evolution of ERP, Integrated Management Systems, Reasons for the growth of ERP, Business Modeling, Integrated Data Model, Foundations of IS in Business, Obstacles of applying IT. Advantages and limitations of ERP.

4. UNIT –IV ERP Modules: Finance, Accounting Systems, Manufacturing and Production Systems, Sales and Distribution Systems, , Human Resource Systems, Plant Maintenance System, Materials Management System, Quality Management System, ERP System Options and Selection, ERP proposal Evaluation.

5. UNIT –V ERP Implementation and Maintenance: Implementation Strategy Options, Features of Successful ERP Implementation, Strategies to Attain Success, User Training, Maintaining ERP & IS**.** Case Studies.

References

1. ***C Laudon and Jane P.Laudon, et al: Management Information Systems, Pearson Education, 2009.***
2. Alexis Leon, ERP (Demystified), 5/E, Tata McGraw-Hill, 2009.
3. David L Olson, Managerial Issues of Enterprise Resource Planning Systems, McGraw Hill, International Edition-2009.
4. Vaman, ERP in Practice, Tata McGraw-Hill , 2009
5. Gordon B. Davis & Margrethe H.Olson: Management Information Systems, Tata McGraw-Hill , 2009.
6. W S Jawadekar: Management Information Systems, Tata McGraw-Hill , New Delhi, 2009
7. James A. Obrein: Management Information Systems, Tata McGraw-Hill , 2008
8. Gerald V.Post, David L Anderson: Management Information Systems, Irvin McGraw Hill, 2009.
9. C.S.V.Murthy: Management Information System, Himalaya publishing House ,2009

10. Rainer, Turban, Potter, Introduction to Information Systems, WILEY-India, 2009.
11. Dharminder and Sangeetha, Management Information Systems, Excel books, 2009
12. Monk, Concepts in ERP, Cengage, 2009.
13. Ashim Raj Singla, Enterprise Resource Planning, Cengage, 2008.
14. Vinod Kumar Garg, et al., Enterprise Resource Planning, PHI, 2007.

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SOFT SKILLS LAB
(Activity-based)

- To improve the fluency of students in English
- To facilitate learning through interaction
- To illustrate the role of skills in real-life situations with case studies, role plays etc.
- To train students in group dynamics, body language and various other activities which boost their confidence levels and help in their overall personality development
- To encourage students develop behavioral skills and personal management skills
- To impart training for empowerment, thereby preparing students to become successful professionals

INTRODUCTION

Definition and Introduction to Soft Skills – Hard Skills vs Soft Skills – Significance of Soft/Life/Self Skills – Self and SWOT Analysis *and*

1. Exercises on Productivity Development
- Effective/ Assertive Communication Skills (Activity based)
- Time Management (Case Study)
- Creativity & Critical Thinking (Case Study)
- Decision Making and Problem Solving (Case Study)
- Stress Management (Case Study)

2. Exercises on Personality Development Skills
- Self-esteem (Case Study)
- Positive Thinking (Case Study)
- Emotional Intelligence (Case Study)
- Team building and Leadership Skills (Case Study)
- Conflict Management (Case Study)

3. Exercises on Presentation Skills
- Netiquette
- Importance of Oral Presentation – Defining Purpose- Analyzing the audience- Planning outline and preparing the Presentation- Individual & Group Presentation- Graphical Organizers- Tools and Multi-media Visuals
- One Minute Presentations (Warming up)
- PPT on Project work- Understanding the Nuances of Delivery- Body Language – Closing and Handling Questions – Rubrics for Individual Evaluation (Practice Sessions)

4. Exercises on Professional Etiquette and Communication
- Role-Play and Simulation- Introducing oneself and others, Greetings, Apologies, Requests, Agreement & Disagreement….etc.
- Telephone Etiquette
- Active Listening
- Group Discussions (Case study)- Group Discussion as a part of Selection Procedure- Checklist of GDs
- Analysis of Selected Interviews (Objectives of Interview)
- Mock-Interviews (Practice Sessions)
- Job Application and Preparing Resume
- Process Writing (Technical Vocabulary) – Writing a Project Report- Assignments

5. Exercises on Ethics and Values

Introduction — Types of Values - Personal, Social and Cultural Values - Importance of Values in Various Contexts

- Significance of Modern and Professional Etiquette – Etiquette (Formal and Informal Situations with Examples)
- Attitude, Good Manners and Work Culture (Live Examples)
- Social Skills - Dealing with the Challenged (Live Examples)
- Professional Responsibility – Adaptability (Live Examples)
- Corporate Expectations

Note:

- Hand-outs are to be prepared and given to students.
- Training plan will be integrated in the syllabus.
- Topics mentioned in the syllabus are activity-based.

SUGGESTED SOFTWARE:

The following software from **'train2success.com'**

- Preparing for being Interviewed,
- Positive Thinking,
- Interviewing Skills,
- Telephone Skills,
- Time Management
- Team Building,
- Decision making

SUGGESTED READING

1. Alex, K. 2012. *Soft Skills.* S. Chand Publishers
2. *Management Shapers*. 2011. Collection of 28 Books by different Authors. Universities Press.
3. Sherfield, Robert M. *2005. et al Cornerstone: Developing Soft Skills*. Pearson
4. Suresh Kumar,E; Sreehari, P. & Savithri, J. 2011. *Communication Skills and Soft Skills- An Integrated Approach.* New Delhi: Pearson
5. The ACE of Soft Skills by Gopalaswamy Ramesh & Mahadevan Ramesh. 2013. Pearson Publishers. New Delhi.
6. Patnaik, P. 2011. *Group Discussion and Interview Skills.* New Delhi: Foundation
7. Sudhir Andrews. 2009. *How to Succeed at Interviews.* New Delhi: Tata McGraw Hill
8. Sasikumar, V & Dhamija, P.V. 1993. *Spoken English - A Self-Learning Guide to Conversation Practice.* New Delhi: Tata McGraw-Hill
9. *Dixson, Richard J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd*
10. Mukhopadhyay. L *et al. 2012. Polyskills. New Delhi: CUP India Pvt Ltd*
11. Rizvi, M. A. 2005. *Effective Technical Communication.* New Delhi: Tata McGraw Hill
12. *The Hindu Speaks on Education* by the Hindu Newspaper
13. Naterop, B. Jean and Revell, Rod. 2004. *Telephoning in English*. Cambridge: CUP

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RESEARCH METHODOLOGY & STATISTICAL ANALYSIS
PG CORE-III

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim: To understand the basic statistical tools for interpretation of quantitative and qualitative data.

Learning Outcome: Students will be able to apply the principles of research methodology for the research design for the various mini and major projects of the MBA programme. They will be able to analyse the data statistically.

1. **Research Methodology**: Introduction-Topic-Review of Literature-Research Gaps-Research Questions-Objectives-Hypotheses-Scope of the study-Period of the study-Sampling Techniques-Data Collection-Primary data –Questionnaire design-Secondary data-Data Analysis-Limitations of the study-Appendix-References.

2. **Tabulation, Graphical presentation of data**: Histogram, Diagrammatic representation of data: Bar diagram, Multiple Bar diagram, Sub-divided Bar Diagram, Pie Diagram, Measures of Central Tendency: Mean, Median and Mode. Measures of Dispersion: Range, Standard deviation and Variance, Coefficient of variation, Measure of Skewness.

3. **Linear Correlation and Regression Analysis**: Covariance, Pearson's Correlation Coefficient, Scatter plot, Spearman's rank Correlation Coefficient, Regression lines.

4. **Parametric and Non- Parametric Hypothesis Testing**: Procedure for Testing of Hypothesis, One Sample t-test for the Population Mean, Two Sample t-test for independent Samples, Paired Sample t-test. F-test for two population Variances (Variance ratio test), ANOVA One Way Classification, ANOVA two way Classification, Chi Square test of association, Chi Square test of independence.

5. **Time Series and Data Analysis**: Fitting a trend line to a time series, Method of least Squares and Method of Moving Averages, Measure of Seasonal Variation.

Textbook

1. Glyn Davis & Branko Pecar "Business Statistics Using Excel" Oxford University Press, 2012.

References:

1. P N Arora" Comprehensives Statistics Methods" S. Chand, 2012.
2. Sharma" Business Statistics" Pearson, 2012.
3. David Cooper, Business Research Methods, TMH, 9/e 2013.
4. Zikmund, Business Research Methods, Cengage, 2012.
5. S C Gupta, "Fundamentals of Statistics", HPH, 2012
6. C B Gupta " An introduction to Statistical Methods" Vikas, 2012
7. S L Gupta 'Business Research Methods" TMH, 2012.
8. Pannerselvam" Research Methodology" PHI, 2012.
9. Ranjit Kumar "Research Methodology" Sage, 2012.
10. R P Hooda "Statistics" Vikas, 2012
11. Newbold" Statistics for Business and Economics" Pearson, 2012.
12. Levin, Rubin, Rastogi & Siddiqui, "Statistics for Management" Pearson, 2013
13. Mukul Gupta & Deepa Gupta "Research Methodology" PHI, 2013.
14. Bhardwaj : Mathematics and Statistics for Business, Excel, 2013.

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BUSINESS LAW AND REGULATION
PG CORE-IV

(Students must read textbook along with cases. Faculty are free to choose any other cases)

Course Aim: The aim of this course is to enable students understand legal and regulatory framework for doing business in India.

Learning Outcome: After going through the text and case lets in terms of various court judgements, the students should be able to understand the formalities involved in incorporating a company and the nuances related to the Law of Contract. The student will also be able to know the implications of direct and indirect taxes, negotiable instruments Act and also about the cyber laws.

1. Companies Act, 1956: Steps and procedure for incorporation of the company, Appointment of Directors, Powers, duties, & liabilities of Directors, Company Meetings, Resolutions, Winding-up of a Company.

2. Law of Contract: Nature of contract and essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and free consent, Legality of object. Unlawful and illegal agreements, Contingent contracts, Performance and discharge of contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

3. Direct and Indirect Tax: Income Tax Act -1961 - Important Provisions of Income Tax Act: Assessment year –Assesee, Gross Total Income, Procedure for advance payment of tax and tax deducted at source. Assessment procedure. Central Excise Act -1944: .Basic concepts related to excisable goods, classification of goods, and Basic concept of VAT.

4. Negotiable Instruments Act - 1881: Negotiable Instruments- Promissory Note, Bills of Exchange, & Cheque, and their definitions and characteristics, Types of endorsements, Holder- Holder in due course, Discharge of Parties.

5. Cyber Crime and the Legal Landscape-the world-Why do we need cyber laws in tha indian context-The indina IT act-challenges to indian Law and cyber crime scenarion in india. (Refer Nina Godbole & Sunit Belapure)

Textbook:
1. **RSN Pillai, Bagavathi, Business Law, S.Chand, 2013.**

References
1. Akhileshwar Pathak: Legal Aspects of Business, TMH, 4/e, 2013.
2. Nina Godbole & Sunit Belapure " Cyber Security" Wiley India 2012.
3. K.R. Bulchandani: Business Law for Management, 5/e, Himalaya Publishing House (HPH), 2012
4. Ravinder Kumar "Legal Aspects of Business", 2nd Edition Cengage Learning, 2012.
5. Kuchal: Business Law, Vikas, 2011
6. Tulsian:Business Law, TMH, 2012.
7. S S Gulshan, Business Law, 4th edition, Excel Books, 2012
8. S.N. Maheshwari, S K Maheshwari, A Manual of Business Laws, Himalaya Publishing House (HPH), 2013.
9. C L Bansal, Business and Corporate Laws, Excel Books, 2011.
10. Tejpal Sheth, Business Law, Pearson, 2012
11. P.K.Padhi, Legal Aspects of Business, PHI, 2013

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INTEGRATED MARKETING COMMUCATION
PG Elective-II (Marketing)

(Students must read textbook. Faculty are free to choose any other cases)

Aim: The aim of this course is to a) enable students to understand management of marketing communication, marketing mix and ethical aspects of marketing communication b) choose a marketing communications mix to achieve the communications and behavioral objectives of the IMC campaign plan.

Learning outcome

- The student should be able to design innovative integrated marketing communication strategies for a given product or service using social media
- Students will able to create an integrated marketing communications plan to promote IMC strategies and to measure their effectiveness.

1. **Understanding Integrated Marketing Communication**: Understanding Marketing Communication, Integrated Marketing Communication, Integrated Marketing Communication as an Integral part of Marketing, Understanding Consumer Behaviour, Understanding the Communication process, Communication Mix.
   Case : Cadbury Manages a Crisis with Integrated Marketing Communications (Kruti Shah page no 59)

2. **Budgeting, Objectives and Evaluation of IMC**: Setting Communication Objectives, DAGMAR Approach to setting objectives and measuring advertising effectiveness, allocating the Marketing Communication Budget, Conducting research to measure communication effectiveness, Post-Testing tools and techniques, Evaluating other promotional tools and IMC.
   Case : The Premium Milk Food Private Ltd. (Kruti Shah page no 820)
   Case : Archias, Advertizing (Jaishri Jethwaney, Shruthi Jain, Oxford, page no 195)

3. **Marketing Communication Mix I:**
   Creative Execution in Advertising, Decision in Print, Execution on Radio, Execution on online and television, getting that 'Big Idea' of creativity.
   Case : Tata Salt (Part I,II,III) (Kruti Shah page no 282,284,310-311,367-372)

4. **Marketing Communication Mix II**:
   Sales Promotion, Direct Marketing, Personal Public Relations, Publicity and Corporate Advertising, Unconventional Promotional Media: Sponsorships, Mobile Advertising, Word Of Mouth, Village Farmers, Out of Home Media, World Wide Web Communications.
   Case : Amul taste of India (Kruti Shah page no 793)
   Case : Rasha Prankees promotion (Kruti Shah page no 600)

5. **Regulation, Social and Ethical Aspects of Advertising and Promotion**:-
   Federal Regulation of Advertising, regulations of Advertising and Promotion in India, regulation of other Promotional Areas, Social and Ethical Criticisms of Advertising, ethical aspects of Advertising – Truth in Advertising, Advertising to children, Advertising controversial products, Social Aspects of Advertising.
   Case : Surrogate advertising(Jai shri Jethwaney page no 475-480)
   Case : The Unilever experience (Jai shri Jethwaney page no 606)

Textbook:

- **Krutishah, Alan D'Souza, Advertising and promotions on IMC Perspective, TMH, 2012**.
  Journal : MICA Communications Review – A Marketing Communications Journal, Mudra Institute of Communications, Ahmedabad.

  Businesss Game : AdSim Advertising: (Advertising & Promotion Simulation Game), TMH, 2013. You can play on any computer with internet (Rs.150/- per year-better buy and play)**.**
  AdSim is a simulation game for the **Advertising & Promotion** course, where the students are required to formulate and implement their own Advertising and Promotion campaign. This helps the students to have an hands – on business experience in the classroom – experiential learning at its best.

References:

1. Jaishri Jethwaney, Shruthi Jain, Advertising Management, Oxford, Second edition, 2012.
2. George E Belch, Michael A Belch , Keyoor puravi , Advertising and Promotions – An Integrated Marketing Communications perspective , TMH, 2013.
3. Semenile , Allen, O Guinn , Kaufmann, Advetising and Promotions, An Integrated brand approach, Cengage, 6th edition , 2012.

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MANAGEMENT OF INDUSTRIAL RELATIONS
PG Elective – II (HR)

(Students must read textbook. Faculty are free to choose any other cases)

Course objectives:

1. The aim of the course is to enable HR elective students develop awareness towards labour laws.
2. The students will be introduced, how to deal with legal problems emanating from employer and employee relations in organizations.
3. To introduce the students with the concept of collective bargaining, employee welfare, wage policy act.

Learning Outcomes:

1. The student understands the industrial relations, its importance in HR
2. Various Labour Laws like Factories Act, Wage and Bonus Act and Dispute Preventive and Corrective Mechanisms are learnt.
3. They will also understand the role of Trade Unions, Settlement of disputes, Collective Bargaining, Wage Policy.

1. Industrial Relations: Introduction, Dunlop's Industrial Relations Systems, Characteristics of Indian IR System; Trade Unions: Union Purpose. Trade Union , Functions, Methods, Politics, Types of Unions, Trade Unions in India: Union Structure and characteristics. Recognition of Unions: States provisions for Recognition. Rights of recognized Unions, Unfair Labour Practices:
   Case 1. Let us get back to work (p.no. 720, C.B.Mamoria)
   Case 2. A case of complicated multi-union manoeuvres (J.A. Kulkarni)

2. Settlement of Disputes: Role of state Dispute Settlement Machinery and its instruments, Legislation: Causes of disputes, Right to Strike, Major Strikers, Tripartite and Bipartite Bodies, Standing orders and Grievance Procedure.
   Case 1. Stop the shouting game please (p.no. 760, C.B.Mamoria)
   Case 2. The dish ends ltd. (p.no.07, J.A. Kulkarni)

3. Collective Bargaining, Conciliation, Arbitration, Adjudication, The Industrial Dispute Act 1947, Labour Welfare work, Labour Welfare officer, Worker's Participation.
   Case 1.who is to be blammed (p.no. 685, C.B.Mamoria)

4. Wage Policy and Wage Regulation Machinery, Wage Legislation, Payment of Wages Act 1936, The Payment of Bonus Act,1965
   Case 1. Rules and regulations still guide actions at UPS (p.no. 37, C.B.Mamoria)

5. The Factories Act 1948, Mines Act 1952, Industrial Relations and Technological Change.
   Case 1. Organizations and unions working as partners (p.no. 738, C.B.Mamoria)

Textbook:

- **Mamoria, Mamoria, Gankar "Dynamics of Industrial Relations" Himalaya Publishing House.2012.**

Cases:

1. **C.B.Mamoria, VSP Rao "personnel management- text & cases", Himalaya Publishers 13th edition, 2012.**
2. **J.A.Kulkarni, Asha Pachpande, Sandeep Pachpande, "case studies in amangement", pearson, 2011.**

References:

1. Dr K S Anandram “Cases in Personnel Management Industrial Relations and Trade Relations” Everest, 2012.
2. Arun Monappa,Ranjeet Nambudiri,Selvaraj “ Industrial Relations and Labour Laws” , TMH,2012
3. A.M.Sharma “Industrial Relations and Labour Laws”, Himalaya Publishing House,2013.
4. Ratna Sen “Industrial Relations-Text and cases “Macmillan Publishers,2011.
5. Kubendran.V,Kodeeswari.K “Industrial Relations and Labour Laws “Himalaya Publishing House,2011.
6. Punekar S.D,Deodhar S.B, Saras wathi Sankaren”Labour Welfare,Trade Unionism and Industrial Relations, “Himalaya Publishing House,2012.
7. B.D.Singh “Industrial Relations”Excel Books 2008.
8. S C Srivastava “Industrial Relations and Labor Laws” Vikas, 2012.
9. Padhi “ Labour and Industrial Relations” PHI, 2012.
10. Venkata Ratnam “Industrial Relations” Oxford, 2012.

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SECURITY ANALYSIS PORTFOLIO MANAGEMENT
PG Elective-II (Finance)
(Students must read textbook. Faculty are free to choose any other cases)

Course Aim: To Understand the investment alternatives, process and portfolio management
Learning Outcome: The objective of this course is to provide the conceptual and Practical understanding of Stock markets Equity & Bond Valuation , Cash market and also Mutual funds.

1. a) Investment Environment in India, overview of Indian financial system securities trading in stock markets, investment alternatives, the investment management process.
   b) Security Analysis: Fundamental Analysis, Technical Analysis, EMH (Efficient Market Hypothesis)
2. Portfolio Analysis: The returns and risks from investing- Markowitz portfolio Theory, Mean-variance approach, portfolio selection-efficient portfolios, The single index model-capital asset pricing model, arbitrage pricing theory.
3. Bond Analysis & Valuation & management: Types of bonds, Interest rates, Term Structure of interest rates, measuring bond yields, Yield to Maturity, Yield to Call, Yield to Maturity, Holding Period Return, Bond pricing theorems, bond duration, Active and Passive bond management Strategies, bond immunization, bond volatility, bond convexity.
4. (a) Equity Valuation : Equity Analysis & Valuation, Balance sheet Analysis equity valuation models, intrinsic value & market price, The P/E Ratio & Earnings multiplier Approach, CAGR, Price/Book value, Price/ Sales ratio, Economic Value Added (EVA) and MVA.
   (b) Derivatives: Overview of derivatives Markets, Option Markets, Option Strategies and option valuation forward & future markets, Strategies. Stock index futures, interest rate futures, Swaps contracts.
5. Mutual Funds: Types of Mutual Funds Schemes, Structure, NAV(Net Asset Value),Risk and Return, Performance Evaluation Models- Sharpe Model, Trey nor Model, Jensen Model, Fama's Decomposition. Trends in Indian Mutual Funds.

Textbooks:

1. **William. F.Sharpe, Gordon j Alexander & Jeffery V Bailey: Fundamentals of Investments, Prentice Hall,2012.**

   Journals : Vikalpa, IIMA, IIMB Review, Decision, IIMC, Vision, MDI.

   Business Game : Stock-Trak: (Finance Simulation Game), TMH, 2013- You can play on any computer with internet (Rs.150/- per year-better buy and play)**.**
   Stock-Trak is the most comprehensive, Online investment simulation game for **Finance** students to trade on Stocks, bonds, mutual funds, options, futures, spots, future options and international stocks with virtual money. This game is created specifically for classroom use and students can play this game 24*7 to give them hands-on experience on Investments.

References:

1. Reilly, Brown: Analysis of Investment and Management of Portfolios, 10th Edition, Cengage, 2012.
2. ZVI Bodie, AlexKane, Alan J Marcus : Investments, TMH, 2012.
3. Donald E Fischer, Ronald J Jordan: Security Analysis and Portfolio Management, 6th Edition, Pearson, 2012.
4. Prasanna Chandra: Investment analysis and Portfolio Management" 4th Edition, TMH, 2012.
5. Punithavathi Pandian : Security Analysis and Portfolio Management, Vikas. 2012.
6. Jones: Invest Analysis and Management, Wiley.
7. M. Ranganatham, R. Madhumathi: Security Analysis and Portfolio Management, 2nd Edition , Pearson, 2012.
8. Edwin J Elton, Martin J Gruber, Stephen J Brown, William N.Goef Z Mann : Modern Portfolio
9. Theory and Investment Analysis. 2013.

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ENTERPRISE RESOURCE PLANNING
PG Elective – II (SYSTEMS)
(Students must read textbook. Faculty are free to choose any other cases)

Course Objectives
1. To provide students the foundations of ERP planning and system options
2. To provide framework of general and specialized modules of ERP
3. To provide students a risk-benefit analysis of ERP system

Learning Outcomes
1. Students understand a) integration of various ERP modules with each other and with Business Environment b) the issues in operation and implementation of a successful ERP system and c) how to face the challenges associated with the present and future ERP systems..

1. Introduciton to ERP- Foundation for Understanding ERP systems-Buisiness benefits of ERP-The challenges of impelmenting ERP system-ERP modules and Historical Developement.
   Case: Response top RFP for ban ERP system (Mary Sumner).

2. ERP system options & Selection methods-Measurement of project Inpact- information Technology Selection-ERP proposal evaluvation-Project Evaluvation Technique.(David L.olson).
   Case: Atlantic Manufacturing (Mary Sumner).

3 ERP system Installation Options- IS/IT Management results-Risk Identificatioon analysis-System Projects- Demonstation of the system-Failure method-system Architecture & ERP (David L.Olson)
   Case: DataSolutiions & Technology Knowledge (Mary Sumner).

4 ERP - sales and Marketing- Managment control process in sales and markring-ERP custoemr relatonship managment-ERP systems- Accounting & Fiance control processes. Fiancial modules in ERP systems.
   Case: atalantic manufacturing (Mary Sumner).

5 ERP – Produciton and Material Managment-Control process on produciton and manuifacturing-Produciton module in ERP- supply chain Managmeent & e-market place-e-businesss & ERP-e supply chian & ERP- Future directions for ERP.
   Case: HR in atalntic manufacturing. (Mary Sumner).

Textbook:
1. **Mary Sumner " Enterprice Resource Planning" Pearson, 2012**.

Referencs:
1. David L.Olson " Managerial Issues in ERP systems" TMH 2012.
2. Ellen Monk "Enterprice Resource Planning" Cengage, 2012.
3. Alexis Leon "Enterprice Resource Planning" 2e, TMH ,2012
4. Goyal "Enterprice Resource Planning" TMH, 2012
5. Jagan Nathan Vaman "ERP Srategies for Steering Orgnizationsal competence and competetive Advantage" TMH, 2012.

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IDP (B.Tech. Mech. Engg. & M.Tech. / MBA) IV Year II-Sem **L T P C**
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STATISTICAL ANALYSIS LAB USING SPSS / EXCEL

Course aim: The course aims is to understand MS Excel for applying statistical tools learnt in RMSA.

Learning Outcome: The learning outcome is that the students should be able to:
- Analyse the data to draw inference for decision making.
- Understand application of statistical measures of central tendency.
- Understand application of ANOVA.
- Analyse trends.
- Test hypotheses.

Syllabus - PART A

About EXCEL
1. Introduction, Uses of Excel, New functions and features of excel 2007.
2. Getting started with excel: Opening a blank or new workbook, general organization.
3. Highlights and main functions: Home, Insert, page layout, formulas.
4. Highlights and main functions: Data, review, view, add-inns.
5. Using the Excel help function.

General EXCEL Lessons
6. Customizing the Quick Access Toolbar.
7. Creating and Using Templates.
8. Working with Data: Entering, Editing, Copy, Cut, Paste, Paste Special.
9. Formatting Data and Using the Right Mouse Click.
10. Saving, Page Setup, and Printing.
11. Using Headers and Footers.
12. Manipulating Data, using Data Names and Ranges, Filters and Sort and Validation Lists.
13. Data from External Sources.
14. Using and Formatting Tables.
15. Basic Formulas and Use of Functions.
16. Data Analysis Using Charts and Graphs.
17. Managing, Inserting, and Copying Worksheets.
18. Securing the Excel Document (Protect Cells and Workbook).

ADVANCED EXCEL LESSONS
19. Advanced Formulas and Functions.
20. Advanced Worksheet Features.
21. Advanced Data Analysis using PivotTables and Pivot Charts.

PART B – STATISTICAL TOOLS FOR EXECUTION USING EXCEL

I. Tabulation, bar diagram, Multiple Bar diagram, Pie diagram, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation.
II. Correlation, regression lines.
III. t- test, F-test, ANOVA one way classification, chi square test, independence of attributes.
IV. Time series: forecasting Method of least squares, moving average method.
V. Inference and discussion of results.

Text
1. Glyn Davis & Branko Pecar “Business Statistics Using Excel” Oxford University Press, 2012.

References:
1. David Whigham “Business Data Analysis Using Excel’’ Oxford University Press, 2012.
2. Winstion “Excel 2010 Data Analysis and Business Modelling” PHI Learning Private Limited.
3. Bajpai “Business Statistics” Pearson, 2013.
4. D P Apte : Statistical Tools for Managers USING MS EXCEL, Excel, 2012.
5. Bruce Bowerman, Business Statistics in Practice, TMH, 5/e 2012.
6. Shelly, MS Office, 2007, Cengage, 2009.
7. Robert H Carver, Doing Data Analysis with SPSS, Cengage, 2013

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STRATEGIC MANAGEMENT
PG CORE-V
(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
The aim of this subject is to enable the students develop a holistic perspective about Strategic management of an organization

Learning Outcome:
By reading the text and discussing the cases students should be able to understand how to scan internal and external environment of an organization, understand different types of strategies and structures, strategies of the competitors, turnaround strategies, global strategies and strategic control. With that knowledge they would be able to formulate strategies, change strategies if necessary and implement strategies. They will also be able to evaluate strategies and take corrective steps.

Unit-I:
Strategic Inputs: Introduction to Strategic Management-Strategic Management and Competitiveness-Technology and Technology change-Vision, Mission and Objectives-Strategic Leaders-Strategic Management process-The External Environment: Opportunities, Threats, Competition and Competitor Analysis. External Environmental Analysis, Segments of the External Environment, Porters 5 Force Model, The internal Environment: Resource, Capabilities, Competencies and Competitive advantages. Analyzing internal organization - Building Core Competencies - Value Chain Analysis, Outsourcing.
Case:Bharti Airtel (Hitt & Irelandpage no 4).
Case: ITC Limited (Hitt & Irelandpage no 30).

Unit-II: Formulation of Strategic Actions: Business level strategy-Effectively managing relationships with Customers-the purpose of Business strategy. Competitive Rivalry and Dynamics - A Model of Competitive Rivalry-Competitor Analysis-Drivers of Competitive actions and responses-Competitive rivalry and dynamics.
Case:Bajaj Auto limited (Hitt & IrelandPage no 80).
Case: Coca cola Vs Pepsi in India (Hitt & Irelandpage. no108)

Unit-III: Corporate level Strategy-Levels of Diversifications and reasons-Value creating diversifications. Strategic Acquisitions & Restructuring - Popularity of Mergers & Acquisitions strategies, problems in achieving Acquisition Success-Restructuring.
Case: Foster's Group Diversification into the Wine Business (Hitt & IrelandPage 150)
Case: Merger and Acquisition Activity during a Global Crisis: Global and in India (Hitt & Ireland page 154) Focus : Troubles in the Godrej –P & G Alliance(Hitt & Irelandpage. no 223)

Unit-IV: Global Strategy-Identifying International Opportunities and international Strategies-Strategic competitive Outcomes and risk in an international Environment. Corporate Implications for strategy-Strategic Alliances-corporate level cooperative strategy, Competitive risk with Cooperative strategies.
Case: Entry into India & China by Foreign Firms and Indian/Chinese Firms Reaching for Global markets (Hitt & Irelandpage. no 176).
Case: Using Cooperative Strategies at IBM (Hitt & Ireland page 206)

Unit-V: Structure and Controls with Organizations-Organizational Structure and controls, Evolutionary Patterns of strategy and organizational structure. Leadership Implications for Strategy - Entrepreneurial Implications for Strategy. Fundamental principles of Ethics, Professional Ethics, Ethics of Finance & Accounting professionals, Cyber crimes, Ethics & Human rights
Case 1 CISCO's Evolution of Strategy and Structure. (Hitt & Irelandpage. no 256)
Case 2 selecting a new CEO (Hitt & Irelandpage no 282)
Case 3 The Continuing innovation revolution at Amazon: The kindle and E-books(Hitt & Ireland page 304)

REFERENCES:

- Hitt & Ireland and Manikutty," Strategic Management: A South Asian Perspective": Cengage Learning, 9e, 2012
- Mital; Cases in Strategic Management; 3rdEdition, TMH, 2015.
- Mason A Carpenter et al."Strategic Management: A dynamic Perspective"Pearson,2e, 2012.
- A Nag" Strategic Management:Analysis, Implementation & Control "Vikas Publishing house, 2012.
- Adrian & Alison" Strategic Management: Theory & Application" Oxford UniversityPress, 2010.
- C.L.Bansal, Business and Corporate Laws, 1/e, Excel Books, 2006

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RETAILING MANGEMENT
PG Elective-III (Marketing)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim: The main aim of this course is a) to enable students to gain an insight into retailing industry and shopping environment. b) to familiarize them with concepts of Retailing through cases and motivate them to go for a career in retailing industry.

Learning outcome:

a. To enable the students to link Modern Retailing Concepts to cases and understand the present Retailing Trends.
b. To facilitate the students to be able to managing retail operations efficiently and effectively.

1. **Introduction to Retail Management** - Meaning of Retail & Retailing, History, types, functions, utilities, theories of retailing, e-tailing, structure of Indian retail industry, retailing in Asia, global retailing, retailing in Europe, service retailing, FDI retailing, Rural marketing, ethics in retailing.
   Case: The Classic story.(Aditya page no 283)
   Case: The Panwallah. (Aditya Prakash page no 287)

2. **Understanding Shoppers & Shopping** - Shopping Environment, shopping in a Socio Cultural Contest, shopping process shopping behaviour, demographics of Indian shoppers, psychographic profile of Indian shoppers, lifestyle of Indian shoppers, shopping patterns in India.
   Case: Multinational Fast Food Chains in India. Retail Management (Suja Nair page no 474)
   Case: Changing Indian Consumers. (Aditya page no 258)
   Case: Tanishq. (Suja Nair page no 440)

3. **Delivering Value though Retail Functions** - Classification of formats, ownership-based, store based, non-store based, other retail formats, Value Based Model of store format choice, attribute based model of store format choice, the competitive market place, Marketing Structure, the demand side of retailing, non price decisions, types of competition, evolution of retail competition, future changes in retail competition.
   Case: Nirula's. (Suja Nair Page no 448)
   Case: Hot Breads. (Suja Nair page no 452)
   Case: McDonalds India. (Suja Nair page no 459)
   Case: Automobile and Niche Marketing (Dr. Harjit Singh page no 417)

4. **Pricing & Supply Chain Management -** Pricing Objectives & Policies, Interactive Pricing Decisions, different Pricing Strategies, Price Adjustment Strategies. SCM- introduction, derivers of SCM, SCM & competitive advantages, types of supply chain-supply chain length, width, control of supply chain, framework of Supply Chain Management-SCM network structure, Supply Chain Business Process, SCM components, Retail Inventory Management, Retail Logistics Management, EDI in SCM.
   Case: Café Coffee Day. (Suja Nair page no 434)
   Case: Shoppers stop. (Suja Nair page no 470)

5. **Retail Buying & Managing Retail Operations**-objectives of buying, organization buying, retailing buying behaviour, models of buying behaviour, buyer-responsibilities, merchandising & assortment plans-merchandise plan, merchandise plan for basic stocks retail buying groups, negotiations in retail, contract in retail, store layout & design, merchandise display-fixtures, positioning of merchandise, materials & finishes – floors, interior walls, ceilings, lightings, music, graphics-exterior signage, interior signage, layouts for e-tailers.
   Case: Godrej and Boyee's. (Suja Nair page no 466)

Textbook

- Piyush Kumar Sinha, Dwarika Prasad Uniyal, Managing Retailing, 2nd Edition, Oxford, 2012.

Journals : Vikalpa, IIMA, IIMB Review, Decision, IIMC, Vision, MDI, MICA Communications Review – A Marketing Communications Journal, Mudra Institute of Communications, Ahmedabad.

References:

1. Lusch, Dunne, Carver, Introduction to Retailing, 7th Edition, Cengage Learning, 2013.
2. **Suja Nair**, Retail Management, Himalaya Publication House, 2012.
3. **Aditya Prakash** Tripathi, Noopur Agrawal, Fundamentals of Retailing (text and cases), Himalaya Publication House, First Edition, 2009.
4. Swapna Pradhan, Retail Management-Text & Cases, TMH, 2013.
5. Dr. Harjit Singh, Retail Management a global perspective text and cases, S.Chand, 2011.
6. Michael levy, Barton Weits, Ajay Pundit, Retailing Management, McGraw-Hill, 2011.
7. Arif sheikh, Kaneez Fatima, Retail Management, Himalaya Publication House-2012.
8. Chetan Bajaj, Rajnish tuli, Nidhi Varma ,Srivastava, Retail Management, 2nd edition, oxford, 2012.
9. David Gilbert, Retail Marketing Management, 2nd edtion, Pearson, 2013

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SERVICES MARKETING
PG Elective-IV (Marketing)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
To facilitate the students about the concepts of Services Marketing through cases.

Learning Objective: The objective of the course is to provide a deeper insight into the Marketing Management of companies offering Services as product. The students will be able to understand the characteristics of services, understand consumer behaviour in services, align service design and standards, delivering service, managing services promises.

1. **Foundations of Service Marketing:** What are Services? Why Services Marketing? Role of Services in Modern Economy, Service and Technology, characteristics of services compared to goods, Services Marketing Mix, staying focusing on customer, Gaps model of Service Quality-Customer Gap, Provider Gap, Closing Gap.
   Case 1: The United Indian Bank (Govind Apte Page no 55-56)
   Case 2: Online air travel: Expedia, Orbitz and Travelocity lead the pack (John E.G.Bateson Page no 82-83)

2. **Focus on the Consumer:** Consumer behaviour in services, Consumer expectations in service, consumer perceptions of service, Understanding Consumer Requirements-listening to customers through research, building customer relationships, service recovery.
   Case1: The Crestwood Inn, (John E.G.Bateson Page no 320-321)
   Case 2: Population growth and the urban poor (Vinnie Jauhari, Kirti Dutta Page no 106-108)

3. **Aligning Service Design and Standards:** Service innovation and design-challenges, types of service innovations, stages in service innovation and development, service blueprinting, high performance service innovations, new Service Development Processes, Customer defined service standards-factors, types, and development, Physical Evidence and the Services cape.
   Case 1: Physical evidence a case of KF. (Vinnie Jauhari Page 236-238).
   Case 2: IT Trainers Limited. (Govind Apte Page no 186).

4. **Delivering and Performing Service:** Employee's roles in service delivery, customer's roles in service delivery, delivering service through intermediaries and electronic channels, managing demand and capacity.
   Case 1: Relationship between Employee satisfaction, Customer satisfaction and market share: The case of Hewlett-Packard, (Vinnie Jauhari Page 336).
   Case 2: Total Assurance Ltd. (Govind Apte Page 207-208).

5. **Managing Service Promises:** Integrated services marketing communications-need for coordination, five categories of strategies to match service promises with delivery, Pricing of Services-three key ways that service prices are different for customers, approaches to pricing services, pricing strategies that link to the four value definitions.
   Case 1: Why Differential Pricing helps the poor? (Vinnie Jauhari et al Page 336).

Textbook

1. **Valarie A.Zeithaml & Mary Jo-Bitner: Services Marketing – Integrating customer focus across the firm, TMH, Fifth edition, 2011.**

   Journal : MICA Communications Review – A Marketing Communications Journal, Mudra Institute of Communications, Ahmedabad.

References

1. John E.G.Bateson, K.Douglas Hoffman : Services Marketing, Cengage Learning, Fourth Edition, 2012.
2. Harsh V.Varma: Services Marketing text and cases, Pearson, Second edition, 2012.
3. Ravi Shanker : Services Marketing - The Indian Prespective, Excel Books, 2011.
4. Vinnie Jauhari, Kirti Dutta: Services- Marketing, Operations and Management, Oxford University Press,2012.
5. Govind Apte : Services Marketing, Oxford Press, 2011.
6. Christoper lovelock,Jochen wirtz, Jayanta Chatterjee, Services Marketing, 7th edition Pearson 2013.
7. K.Rama Mohan Rao, Services Marketing, 2nd edition Pearson, 2011.
8. Dr. S. Shajahan, Services Marketing, 2nd edition, HPH, 2012.
9. Ramneek Kapoor, Justin Paul, Biplab Halder, Services Marketing Concepts and Practices, TMH, 2011.
10. Rajendra Nargundkar, Services Marketing, , 3rd edition, TMH,2012.
11. R. Srinivasan, Services Marketing the Indian context, 3rd edition, PHI,2012.
12. Dr. B. Balaji, Services Marketing and Management, S.Chand, 2012.
13. Steve Baron, Kim Harris and Toni Hilton, Services Marketing text and cases, Macmillan, 2009.
14. Nimit Chowdhary, Monika Chowdhary, textbook of Marketing of Service the Indian Experience, Macmillian, 2013.

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INTERNATIONAL MARKETING
PG Elective-V (Marketing)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim: To enable the student understand the Global Markets, formulate of Global Marketing Strategies and Implement.

Learning Objective: The objective of the course is to provide a deeper insight into the global marketing management, environment of global markets, assessing global market opportunities, developing and implementing global marketing strategies.

1. **Introduction to International Marketing:** Definition, Scope, Features, Difference between Domestic and International Marketing, Why International? International Marketing Theories, Types of Economics & Markets.
   Case: 1 Starbucks –going Global fast. (Philip, John, Prashant Text)

2. **Environment of Global Markets:** Types: Political, Economical, Social, Legal and Technological Environments, EXIM Policy, International Trade and its barriers trade in Goods & Services.
   Case: 1 IKEA Catalogue. (Svend & Madhurima -Pearson page no 242)
   Case: 2 Mc. Donalds and obesity. (Philip John Prashant Text)

3. **Assessing Global Market Opportunities:** Global vision through Market Research: Market Selection, Role of Culture, Government Policies of Target Markets, SWOT Analysis of Target Markets, International Trade Agreements, World Market Stages.
   Case:1 Reliance Entertainment(Svend & Madhurima, Pearson page no 312)
   Case:2 Mahindra & Mahindra (Svend & Madhurima,Pearson page no 356)
   Case:3. IMAX corporation (Svend & Madhurima, Pearson page no 412)

4. **Developing Global Market strategies:** Segmentation product & services decisions for consumers and Business: Marketing channels and Distribution, Promotion Strategies, Pricing strategies.
   Case:1 Harley-Davidson:-Price level (Svend & Madhurima,pearson page no 510)
   Case:2 Mc Donalds Great Britain –the Turnaround (Text page no 793)

5. **Implementing Global marketing strategies:** Negotiation with customers and selection method, E-Marketing channels organization & controlling of the global marketing programme.
   Case: 1 NTT DOCOMO (Svend & Madhurima,Pearson page no 709)

Textbook

- **Philip R. Cateora, John L graham, Prashant Salwan, International Marketing -13th edition – TMH-2011.**

References

1. Svend Hollensen, Madhumita Benerjee-Global Marketing-4th Edition- Pearson-2010.
2. *Rajagopal –International Marketing*-2nd Edition –Vikas -2011
3. *P.K.Vasudeva, International Marketing-4th edition-Excel Books-2012*
4. Dr.Gajender Sharma- International Marketing-1st edition-Excel Books-2010
5. Justin Paul, International Marketing – Text and Cases, TMH, 2013.
6. Kiefer Lee, Steve Carter-Global Marketing Management-3rd edition-Oxford-2011.
7. Warner J.Keogan, Naval K.Bghargava-Global Management-7th Edition-Person-2011
8. Francis Cherunilam- International Marketing-12th Edition-HPH-2012.
9. Rathor, Jani,Rathor- International Marketing-4th edition- HPH-2011

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COMPENSATION & REWARD MANAGEMENT
PG Elective – III (HR)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
It enables the student understand the concepts issues and challenges of compensation and reward management.

Learning Outcome:
The student understands how to design the compensation for various levels of jobs in the organization, designing the compensation for special groups. Government and legal issues in compensation design.

1. The Pay Model Strategy: The Totality of Decisions, Defining Internal Alignment, Job Analysis, Evaluating Work, Job Evaluation, person-based Structures.
   Case: So you want to lead an orchestra (George T Milkovich page no 72)
   Case: Job Evaluation at whole foods (George T Milkovich page no 125)

2. Defining Competitiveness, Designing pay levels, Mix and pay structures, pay for performance. The Evidence pay for performance plans.
   Case: Burger Boy(George T Milkovich page no 249)
   Case: Incentives in the club House(George T Milkovich page no 279)

3. Performance Appraisals, Benefits Determination Process, statutory Benefits including Health care, Employee welfare and Retirement Benefits.
   Case: Merit pay: Making policies and practices that work (George T Milkovich page no 319)

4. Compensation of Special Groups, Union role in wage and Salary administration. International pay systems.
   Case: Compensation of special groups (George T Milkovich page no 443)
   Case: Coke and IBM(George T Milkovich page no 491)

5. Government and legal issues in compensation Public sector pay Management: Making it work.
   Case: Communicating by copier(George T Milkovich page no 575)

Textbook:

- **George T Milkovich, Jerry M Newman, C S Venkata Ratnam" TMH,2013.**

References:

1. B D Singh "Compensation and Reward Management" Excel books,2012
2. Joseph J.Martocchio "Strategic Compensation" Pearson, 2012.
3. Kanchan Bhatia "Compensation Management" Himalaya, 2012.
4. Henderson "Compensation Management in a Knowledge Based World" 3e, Pearson, 2012.
5. Luis R.FGomez- Mejia "Compensation and Organizational Performance" Yesdee Publishing, 2012.
6. Michale Armstrong" Employee Reward" University Press, 2012.
7. Barry Gerhart, "Compensation" Sage, 20

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MANAGEMENT OF CHANGE
PG Elective – IV (HR)
(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
The course enables the student to understand the concept change management. This will help them to emerge as leaders in the organizations.

Learning Outcome:
The student understands the need to bring change, how to design change in the organizations, role of leadership in change management, change communication and resistance to change and the role of HR in change management.

1. Managing Change Conundrums, Organizational change classifications, History and organizational change. The role of paradigms and perspectives. External and Internal change contexts.
   Case: Changing times at Factory Bank (Mark Hughes page no 70)

2. Organizational design and change, strategic level change, Group and team level change, and Individual level change. Organizational Structure. Organizational Culture and Management of Change.
   Case: Restructuring at Flexco (Adrian page no 57)
   Case: Cultural change at Dupont Nylone (Adrian page no 65)

3. The leadership of Change, Change communication, resistance to change, Organizational learning, power, politics and Organizational change. Ethics and Managing Change, Change Agents and Agency.
   Case: Funding crisis at Musicians in the community (Mark Hughes page no 221)

4. HR and Managing Change: Recruitment & Selection & The Management of Change, Performance Management &Management of Change, Reward Managements & The Management of Change, Technological Change.
   Case: Recruitment and Selection at Unicol (Adrian page no 117)
   Case: Reward Management at Midland Main Line - Strategic Reward Management (Adrian page no 191).

5. Employee Relations, Involvement Strategies, Management of Change, Downsizing and the Management of Change, Evaluating and Promoting change.
   Case: Downsizing at Energy Co **(**Adrian page no 268)
   Case: Evaluating a possible change to training methods at telesales Incorporated (Adrian page no 300)

Textbook:
- **Mark Hughes, " Managing Change – a critical perspective", Universities Press, 2011.**

References:
1. Adrian Thornhill,Phil Lewis,Mike Millmore. Mark N K Saunders "Managing change", Pearson,2011.
2. John Hayes " The Theory and Practice of Change Management", Palgrave,2012.
3. Robert A Paton "Change Management" 3e , Sage Publications ,2012.
4. Palmer Dunford 'Managing Organizational Change" TMH,2012.
5. Radha R Sharma "Change Management and Organizational Transformation" Mc Grawhill, 2012.
6. Dipak Kumar " Organizational Change and Development" Oxford,2012.
7. Niloanjan Sengupta " Managing Change in Organizations" PHI ,2012.
8. Nic Beech " Managing Change" Cambridge Press" 2012

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PERFORMANCE MANAGEMENT
PG Elective - V (HR)
(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
To give an understanding about performance management and reward system linked with performance.

Learning Outcome:
The students can understand the importance of performance Management, Performance Appraisals, Reward System, and other performance related concepts.

1. Performance Management and reward systems in context, Performance Management process, Performance Management strategic planning.
   Case: Performance Management at Network Solutions,Inc (Herman Aguinis page no 26)
   Case: Performance Management at the University of Ghana (Herman Aguinis page no 48)

2. Defining performance and choosing a Measurement Approach, Measuring Results and Behaviours. Gathering performance Information, Implementing a performance Management System.
   Case: Accountabilities, Objectives and Standards (Herman Aguinis page no 113)
   Case: Evaluating the appraisal form used by a Grocery Retailer ((Herman Aguinis page no 145)

3. Performance Management and employee development, Performance Management skills.
   Case: Implementation of 360 degree feed back system at Ridge intellectual (Herman Aguinis page no 204)
   Case: Was Robert Eaton A Good Coach (Herman Aguinis page no 233)

4. Reward Systems and legal issues, Managing Team performance.
   Case: Possible Illegal Discrimination at Tractors,Inc. (Herman Aguinis page no 265)
   Case: Team Performance Management at Duke University Health systems. (Herman Aguinis page no 283)

5. Relevant Performance related concepts: Bench marking, Six Sigma, Competency Mapping, Balance Score card, Coaching and Mentoring Pygmalion effect, Job Analysis.
   Case: BHEL,EVA Incentive Schemes: (B D Singh page no 589)
   Case: The TCS Approach and experience(B D Singh page no 601)
   Case: NTPC Performance Management System(B D Singh page no 632)
   Case: Performance Management system(PMS) at Bharti Telecom**(**B D Singh page no 663)

Textbook.
1. **Ram Kumar Balyan, Vikramender Singh & Suman "Performance management text and cases", Himalaya Publications, 2011**.

Reference
1. Herman Aguinis, " Performance Management" Pearson, 2012.
2. Anjali Ghanekar' Essentials of Performance Management' Everest Publishing House, 2010
3. Lance A Berger & Dorothy R Berger " The Talent Management Hand Book" 2nd edition TMH, 2013.
4. B D Singh, " Performance Management System- a holistic approach" excel Books,2010
5. Prem Chadha "Performance management" Macmillan, 2012.
6. Srinivas K Kandula "Performance Management" PHI, 2010.
7. R K Sahu : Performance Management System, Excel, 2013

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STRATEGIC INVESTMENT AND FINANCING DECISIONS
PG Elective – III (Finance)

(Students must read textbook. Faculty are free to choose any other cases)

Aim:
To develop an understanding of the role of financial strategy, in the investing, financing and resource allocation decisions with in an organization. To develop an understanding of the various strategies that are in use to trade off risk and return

Learning Outcome:
To explain the role and nature of investment and financial strategies and its relationship to maximization of wealth/shareholders value. To examine various risk models in capital budgeting. To evaluate the motives for financial implications of mergers and acquisitions and lease financing. To discuss the impact of general and specific inflation on financial and investment strategy decisions.

1. Investment decisions under conditions of Risk and uncertainty: Concepts of risk and uncertainty. Risk Analysis in Investment Decisions. Risk adjusted rate of return, certainty equivalents, probability distribution of cash flows, decision trees, sensitivity analysis and Monte Carlo Approach to Simulation. Investment Decisions under capital constraints: Capital Rationing Vs. Portfolio. Portfolio Risk and diversified projects.

2. Types of Investments and disinvestments: Project abandonment decisions, Evidence of IRR. Multiple IRR, Modified IRR, Pure, simple and mixed investments. Lorie Savage Paradox. Adjusted NPV and impact of inflation on capital budgeting decisions.

3. Critical analysis of appraisal techniques: Discounted pay back, post pay back, surplus life and surplus pay back, Bail-out pay back, Return on Investment, Equivalent Annual Cost, Terminal Value, single period constraints, multi-period capital constraint and an unresolved problem, NPV mean variance analysis, Hertz Simulation and Hillier approaches. Significance of information and data bank in project selections.

4. Strategic Analysis of selected investment decisions: Lease Financing, Leasing Vs. Operating Risk, borrowing vs. procuring. Hire purchase and Instalment decisions. Lease Risk Management, Leasing as a Financing Decision, Advantages of Leasing, and Leasing Decision in practice.

5. Financing Decisions: Mergers and Acquisitions Basic Issues, Strategy , Diversification and Mergers and Acquisitions , Theories of Mergers, Types of Mergers ,Cost of Mergers , Government guidelines for Takeover, Problems on Mergers & Acquisitions and cases

Textbooks:

- **Ravi M Kishore " Strategic Financial Management, Taxman 2012.**

References:
1. Prasanna Chandra: Financial Management, 8/e, TMH, 2012
2. Prasanna Chandra: Projects: Planning, Analysis, Financing Implementation and Review, 6/e, TMH, 2012
3. I.M. Pandey: Financial Management, Vikas 2012.
4. Brigham & Ehrhardt: Financial Management, Text and Cases, Cengage, 2012.
5. G.V.Satya Sekhar, Strategic Financial Management , Himalaya Publishing House 2012
6. MY Khan and PK Jain: Financial Management: Text, Problems & Cases, TMH, 2012.

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INTERNATIONAL FINANCIAL MANAGEMENT
PG Elective – IV (Finance)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
To give an understanding about MNC Financial Management.

Learning Outcome:
The objective of the course is to provide students with a broad view of International Monetary Systems and its understanding to enable a global manager to do business in a global setting. The prerequisite for the course is Financial Accounting and Analysis and Financial Management.

1. International Financial Management: An overview, Importance, nature and scope, International Business Methods, Recent changes and challenges in IFM

2. International Flow of Funds: Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Factors affecting International Trade flows, Agencies that facilitate International flows. Indian BoP Trends. International Monetary System: Evolution, Gold Standard, Bretton Woods's system, the flexible exchange rate regime, evaluation of floating rates, the current exchange rate arrangements, the Economic and Monetary Union (EMU).

3. Foreign Exchange Market: Function and Structure of the Forex markets, major participants, types of transactions and settlements dates, Foreign exchange quotations. Process of arbitrage, speculation in the forward market - Currency Futures and Options Markets, Overview of the other markets – Euro currency market, Euro credit market, Euro bond market, International Stock market.

4. (a) Exchange Rates: Measuring exchange rate movements, Factors influencing exchange rates. Government influence on exchange rates – exchange rate systems. Managing Foreign exchange Risk. International arbitrage and interest rate parity.
   (b) Relationship between inflation, interest rates and exchange rates – Purchasing Power Parity – International Fisher Effect – Fisher Effect.

5. Asset–liability Management: Foreign Direct Investment, International Capital Budgeting, International Capital structure and cost of capital. International Portfolio Management. International Financing: Equity, Bond financing, parallel loans - International Cash management, accounts receivable management, inventory management. Payment methods of international trade, trade finance methods, Export – Import bank of India, recent amendments in EXIM policy, regulations and guidelines.

Textbooks:

1. **Jeff Madura: International Corporate Management, Cengage, 2012.**

References:

1. Alan C.Shapiro: Multinational Financial Management, John Wiley, 2012
2. Sharan.V: International Financial Management 5Th Ed.PHI2012
3. Madhu Vij: International Financial Management, Excel, 2012.
4. Ephraim Clark: International Finance, , Second Edition, Thomson.
5. P.G.Apte: International Financial Management, TMH 2012.
6. S.Eun Choel and Risnick Bruce: International Financial Management, TMH, 2012
7. Reid. W.Click& Joshua D.Coval, PHI 2012

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DERIVATIVES
PG Elective – V (Finance)
(Students must read textbook. Faculty are free to choose any other cases)

Aim:
To give an understanding about the derivatives in stock, commodity and Forex markets.

Learning Outcome:
The objective of this course is to make students efficient in the area of Derivatives, giving them the knowledge of basics in Derivatives, Future Markets, Option Strategies, etc

1. **Introduction to Derivatives** – Development and Growth of Derivative Markets, Types of Derivatives, Uses of Derivatives, Fundamental linkages between spot & Derivative Markets, The Role of Derivatives Market, Uses & Misuses of derivatives.

2. **Future and Forward Market** structure of forward and Future Markets, Mechanics of future markets, Hedging Strategies, Using futures, Determination of forward and future prices, Interest rate futures, Currency futures and Forwards.

3. **(a) Options** – Distinguish between Options and Futures, Structure of Options Market, Principles of Option Pricing, Option Pricing Models: The Binomial Model, The Black – Scholes Merton Model.
   (b) Basic Option Strategies, Advanced Option Strategies, Trading with Options, Hedging with Options, Currency Options.

4. **Commodity Market Derivatives-** Introduction, Types, Commodity Futures and Options, Swaps. Commodity Exchanges- MCX, NCDEX- Role, Functions & Trading. (Refer : M.Ranganatham & R.Madhumathi)

5. **Swaps** – Concept and Nature, Evolution of Swap Market, Features of Swaps, Major types of Swaps, Interest Rate Swaps, Currency Swaps, Commodity Swaps, Equity Index Swaps, Credit Risk in Swaps, Credit Swaps, using Swaps to Manage Risk, Pricing and Valuing Swaps.

Textbooks:
1. **John C Hull: Options, Futures and other derivatives, , Pearson , 2012.**

References:
1. M.Ranganatham & R.Madhumathi : Derivatives and Risk Management, Pearson, 2012
2. Robert A Strong: Derivatives – An Introduction, ThomsonT 2012
3. Gupta: Financial Derivatives, PHI 2012
4. Dubofsky, Miller: Derivatives Valuations and Risk Management, Oxford. 2012.
5. Don M. Chance, Robert Brooks: Derivatives and Risk Management Basic, Cengage. 2012.

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E-BUSINESS
PG Elective – III (SYSTEMS)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
It enables the student understand the concepts of Electronic Business.

Learning Outcome:
The student understands E-Business, its Models, E-Business plans, E-Business Application and Securing E- Business

1. Electronic Business- Understanding new Internet Economy and Business-E-business an e-commerce-Features of E-Business- Advantages of E-Business- Busines Environment-Establishing E-Business.
   Case : Barnes & Noble nad Amazon. Com (Ref 1- Kulkarni).

2. E-Business Models- E-Business Strucutre- E-Business models- E-Business model Design-IT infrastructure requirement of E-business models.
   Case: B2C model at Aradhana Tours. (Ref 1 Kulkarni)

3. Creating E-Business plans- softwareprograms to create a business- Phases /Aspects of E-Business- e-Marketinmg and sales Strategies-website and portal managmenet.
   Case" FLOP (ref 1 :Kulkarni)

4. E-Business Appliications- Characterstics o E-Business applications-Project palning approach for E-Business applications- Application Integration- application in various domains.
   Case Nokia (Ref 1 Kulkarni)

5. Securing your e-business- risk Managment- business continuity planning-Network and web site security-web sire Defacement-Secuiryt audit and Pentration Testing.
   Case: Asmi Agencies-e-market (Ref 1 Kulkarni)

Textbook:
- **Kulkarni et al. "E-Business" Oxford, 2012.**

Reference
1. Dave chaffey, e-business & e- commerece management- strategy, implementation and practice, 5th edition, pearson, 2013.
2. Napier et al " Creating A Winning E-Business" Cengage, 2012.
3. Parad Diwan : e-commerce A Manager's Guide to e-business, Excel, 2013.

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CYBER SECURITY
PG Elective – IV (SYSTEMS)

(Students must read textbook. Faculty are free to choose any cases)

Course Aim:
It enables the student to understand Cyber crime, Tools and methods used in cyber crime and Cyber Security.

Learning Outcome:
The student understands the cyber crimes. Computer forensic system, and Cyber Security.

1. Cyber crime: Mobile and Wireless devices-Trend mobility-authentication service security-Attacks on mobile phones-mobile phone security Implications for organizations-Organizational measurement for Handling mobile-Security policies and measures in mobile computing era.

2. Tools and methods used in cyber crime-Proxy servers and Anonymizers-Phishing-Password cracking-Key loggers and Spywares-Virus and worms-Trojan Horse and Backdoors-Steganography-SQL Injection-Buffer overflow-Attacks on wireless network.

3. Understanding computer forensic-Historical background of cyber forensic-Forensic analysis of e-mail-Digital forensic life cycle-Network forensic-Setting up a computer forensic Laboratory-Relevance of the OSI 7 Layer model to computer Forensic-Computer forensic from compliance perspectives.

4. Forensic of Hand –Held Devices-Understanding cell phone working characteristics-Hand-Held devices and digital forensic- Toolkits for Hand-Held device-Forensic of i-pod and digital music devices-Techno legal Challenges with evidence from hand-held Devices.

5. Cyber Security –Organizational implications-cost of cybercrimes and IPR issues-Web threats for organizations: the evils and Perils-Social media marketing-Security and privacy Implications-Protecting people privacy in the organizations-Forensic best practices for organizations.

Textbook:

- **Nina Godbole & Sunit Belapure "Cyber Security", Wiley india, 2012.**

Reference:

1. Harish Chander, "cyber laws & IT protection", PHI learning pvt.ltd, 2012.
2. Dhiren R Patel, "Information security theory & practice",PHI learning pvt ltd,2010.
3. MS.M.K.Geetha & Ms.Swapne Raman"Cyber Crimes and Fraud Management, "MACMILLAN, 2012.
4. Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.
5. Vivek Sood, Cyber Law Simplified, TMH, 2012.

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INFORAMTION SYSTEM CONTROL AND AUDIT
PG Elective – V (SYSTEMS)

(Students must read textbook. Faculty are free to choose any other cases)

Course Aim:
It enables the student understand the concepts of Information System and Control.

Learning Outcome:
The student understands the audit standards, Audit Process, Computer assistance Audit tools, Managing Audit tools and Strategy and Standards for Auditing.

1. Audit and review the role of Inforamntion Technology-Audit standards-Importance of audit standard independence- AICPA proannouncmenet- The need for IT audit function- role of the IT auditor-Legal implications.
   Cases.

2. Auidit proces in a inforamtion Technology Envionment-Risk Assesmant-Audit budget- Objectives and context-prelimenary review-Feildwork and implermentating audit Methodology-Docukenting results.
   Cases.

3. Computer Assistance Audit tools- Auditor productivity tools-Flowcharting Techniques-Flowcharting an nalytical tool- Defininf critical data-Flowcharting technique-Generalizing audit software-Computer forensic.
   Cases.

4. Managing IT audits- Estabish a career develpement and planning-Evaluvating IT audit quality-criteria for IT audit quality-IT auditing in new millinieum-code of ethics and professional standards-Private industry- Managmeent consultancy.
   Cases.

5. Strategy and standards for Auditing- Strategic palnning- communication- demand managmeent-Architecture and standards- Busines architecture- application and inforamtion architecture-Architecture fuanctions.
   Cases.

Textbook:
- **Sandra Senft & fredrick " Inforamtion Technology Control and Audit " CRC Press, 2012.**

Reference:
- D P Dube, V P Gulati, Information System Audit and Assurance – Includes case studies and chelists from the banking industry, TMH, 2008.