ANNAMALAI UNIVERSITY

DEPARTMENT OF MANUFACTURING ENGINEERING

B.E. MECHANICAL ENGINEERING (MANUFACTURING)

(Four Year Degree Programme)

(Choice Based Credit System)

(FULL–TIME)

REGULATIONS AND SYLLABUS

REGULATIONS

Condition for Admission

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as subjects of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamilnadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma course in Engineering of the State Board of Technical Education, Tamil Nadu (listed in Annexure-1) will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

Branches of Study in B.E.

BRANCH I	-	Civil Engineering
BRANCH II	-	Civil and Structural Engineering
BRANCH III	-	Mechanical Engineering
BRANCH IV	-	Mechanical Engineering (Manufacturing)
BRANCH V	-	Electrical and Electronics Engineering
BRANCH VI	-	Electronics and Instrumentation Engineering
BRANCH VII	-	Chemical Engineering
BRANCH VIII	-	Computer Science and Engineering
BRANCH IX	-	Information Technology
BRANCH X	-	Electronics and Communication Engineering

Courses of Study

The courses of study and the respective syllabi are given separately.

Scheme of Examinations

The scheme of Examinations is given separately.

Choice Based Credit System (CBCS)

The curriculum includes six components namely Humanities / Social Sciences/ Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally have a blend of theory and

practical courses. The total credits for the entire degree Programme is 176 (135 for lateral entry students).

Eligibility for the Degree

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to

1. Earn a minimum of 176 credits (135 for lateral entry students).
2. Serve in any one of the Co-curricular activities such as
    - National Cadet Corps (NCC)
    - National Service Scheme (NSS)
    - National Sports Organization (NSO) and
    - Youth Red Cross (YRC)

for at least one year. The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enroll as a student member of a recognized professional society such as

- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IIChE

Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture/tutorial per week and one credit for two hours or part thereof for laboratory or practical or drawing per week.

Duration of the programme

A student is normally expected to complete the B.E. programme in four years but in any case not more than eight years from the time of admission.

Registration for courses

A newly admitted student will automatically be registered for all the courses prescribed for the first, second and third semesters without any option.

Every other student shall enroll for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 176 (135 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

The slow learners may be allowed to withdraw certain courses with the approval by Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with I Class. A student can withdraw a maximum of 2 courses per semester from IV semester to

VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

The advance learners may be allowed to take up the open elective subjects of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training/project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

Seminar / Industrial Training

The student has to present a seminar on the chosen topic. However, the student can select a topic duly approved by the Seminar Coordinator and the Head of the Department concerned. The student who has presented the seminar has to submit a report and appear for viva-voce examination at the end of the semester.

Project Work

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his / her period of study in an industry and complete his / her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

Industrial Training (Value added courses)

One credit courses shall be offered by a Department with the prior approval from the Dean, Faculty of Engineering and Technology. For one credit course, a relevant potential topic may be selected by a committee consisting of Head of the department concerned and the Board of Studies member from the Department and a senior faculty member from the department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two one credit courses (one each in VI and VII semesters). They shall be allowed to take one credit courses offered in other Departments with the permission of Head of the Department offering the course. A separate mark sheet shall be issued for one credit courses.

Electives

The elective courses fall under two categories: Professional Electives and Open Electives. The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned. Apart from the various Professional elective courses, a student can choose the open electives from any specialization offered in any Department in the Faculty of Engineering &

Technology during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.

Further, the student can also credit not more than two courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent of open electives.

Assessment

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator. The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory / 40 marks for seminar / industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

Attendance requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

Temporary break of study

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

The student applies for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of eight years.

Procedure for withdrawing from the Examinations

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade 'W' appears in the mark sheet for such candidates.

Passing and declaration of examination results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), and prepare the mark sheets.

90 to 100 marks	:	Grade 'S'
80 to 89 marks	:	Grade 'A'
70 to 79 marks	:	Grade 'B'
60 to 69 marks	:	Grade 'C'
55 to 59 marks	:	Grade 'D'
50 to 54 marks	:	Grade 'E'
Less than 50 marks	:	Grade 'RA'
Withdrawn from the examination	:	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

Awarding degree

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

- For First Class with Distinction, the student must earn a minimum of 176 credits within four years (135 credits within three years for lateral entry students) for from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).
- For First Class, the student must earn a minimum of 176 credits within five years (135 credits within four years for lateral entry students) from the time of admission and obtain a CGPA of 6.75 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).
- For Second Class, the student must earn a minimum of 176 credits within eight years (135 credits within seven years for lateral entry students) from the time of admission.

Ranking of Candidates

The candidates who are eligible to get the B.E. degree in the First Class with Distinction will be ranked together on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The Candidates passing with First Class will be ranked next after those with distinction on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

Diploma Programmes Eligible for the B.E (Lateral Entry) Programmes offered in FEAT (from 2017-2018)

Sl.No.	Branches of Study	Eligible Diploma Programme (FT / PT / SW)
1.	**Civil Engineering**	i. Civil Engineering ii. Civil Engineering (Architecture) iii. Environmental Engineering and Pollution Control (Full Time) iv. Architectural Assistantship v. Civil Engineering (Rural Tech.) vi. Civil and Rural Engineering
2.	**Civil and Structural Engineering.**	
3.	**Mechanical Engineering**	i. Mechanical Engineering ii. Mechanical and Rural Engineering iii. Mechanical Design and Drafting iv. Production Engineering v. Production Technology vi. Automobile Engineering vii. Automobile Technology viii. Metallurgy ix. Mechatronics Engineering x. Machine Tool Maintenance and Repairs xi. Tool and Die making xii. Tool Engineering xiii. Tool Design xiv. Foundry Technology xv. Refrigeration and Air Conditioning xvi. Agricultural Engineering xvii. Agricultural Technology xviii. Marine Engineering xix. Mechanical Engineering(Production) xx. Mechanical Engineering(Tool &Die) xxi. Mechanical Engineering (Foundry) xxii. Mechanical Engineering(R & A.C.) xxiii. Electronics(Robotics) xxiv. Mining Engineering xxv. Agricultural Engineering and Farm xxvi. Equipment Technology
4.	**Mechanical Engineering (Manufacturing Engineering)**	

Sl.No.	Branches of Study	Eligible Diploma Programme (FT / PT / SW)
5.	**Electrical and Electronics Engineering**	i. Electrical and Electronics Engineering ii. Electronics and Communication Engg. iii. Electronics and Instrumentation Engg iv. Electronics Engineering(Instrumentation) v. Instrument Technology vi. Instrumentation and Control Engineering vii. Electrical Engineering (Instruments and Control) viii. Electrical Engineering ix. Instrumentation Technology x. Electronics (Robotics) xi. Mechatronics Engineering
6.	**Electronics and Instrumentation Engineering**	
7.	**Chemical Engineering**	i. Petrochemical Engineering ii. Chemical Engineering iii. Environmental Engineering and Pollution Control iv. Leather Technology (Footwear) v. Leather Technology vi. Plastic Technology vii. Polymer Technology viii. Sugar Technology ix. Textile Technology x. Chemical Technology xi. Ceramic Technology xii. Petro Chemical Technology xiii. Pulp & Paper Technology xiv. Petroleum Engineering
8.	**Computer Science and Engineering**	i. Electronics and Communication Engineering ii. Computer Technology iii. Computer Science and Engineering iv. Information Technology v. Computer Engineering vi. Computer Networking vii. Electronics(Robotics) viii. Mechatronics Engineering
9.	**Information Technology**	
10.	**Electronics and Communication Engineering**	

FT- Full Time; PT-Part Time; SW- Sandwich.

COURSES AND CREDITS - SUMMARY

Semester	No. of Courses		HS	BS	ES	PC	PE	OE	S&IT	Proj.	Total Credits
	T+P	Total									
I	4+2	**6**	3*	9	5	-	-	-	-	-	17
			1**	3	2						
II	4+4	**8**	4	13	7	-	-	-	-	-	24
			1	5	2						
III	6+2	**8**	3	4	8	8	-	-	-	-	23
			1	1	3	3					
IV	6+2	**8**	-	4	3	16	-	-	-	-	23
				1	1	6					
V	6+3	**9**	-	-	-	17	8	-	-	-	25
						6	3				
VI	6+3	**9**	-	-	-	10	11	3	-	-	24
						4	4	1			
VII	5+3	**8**	3	-	-	5	8	3	1	-	20
			1			2	3	1	1		
VIII	2+1	**3**	-	-	-	-	-	6	-	14	20
								2	-	1	
Total Courses	39+20	**59**	**4**	**10**	**8**	**21**	**10**	**4**	**1**	**1**	**-**
Total Credits		**-**	**13**	**30**	**23**	**56**	**27**	**12**	**1**	**14**	**176**

* - No of Credits ; ** - No of Courses.

DETAILS OF COURSE CODE

Code (First Two digits)	Details
00	Common course for the faculty
01	Civil Engg. Course
02	Civil and Structural Engg. course
03	Mechanical Engg. Course
04	Mechanical Engg (Manufacturing). Course
05	Electrical and Electronics Engg. Course
06	Electronics and Instrumentation Engg. course
07	Chemical Engg. course
08	Computer Science and Engg. course
09	Information Technology course
10	Electronics and Communication Engg. course
XX	Code of the programme concerned (01 to 10)

Code (3rd and 4th Digits)	Details
HS	Humanities Theory
HP	Humanities Practical
BS	Basic Science Theory
BP	Basic Science Practical
ES	Engineering Science Theory
SP	Engineering Science Practical
PC	Professional Core Theory
CP	Professional Core Practical
PE	Professional Elective Theory
EP	Professional Elective Practical
ST	Seminar / Industrial Training
OE	Open Elective Theory
PV	Project and Viva-voce

5th digit represents the semester and 6th and 7th digits represent the serial number of courses.

COURSES OF STUDY AND SCHEME OF EXAMINATIONS

FIRST SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	HS-I	00HS101	Technical English	4	-	-	75	25	100	3
2	BS-I	00BS102	Engineering Mathematics I	4	-	-	75	25	100	3
3	BS-II	00BS103	Applied Physics I	4	-	-	75	25	100	3
4	BS-III	00BS104	Applied Chemistry I	4	-	-	75	25	100	3
5	ES-I Lab	00SP105	Computer Programming Laboratory	-	1	3	60	40	100	3
6	ES-II Lab	00SP106	Engineering Graphics	-	-	3	60	40	100	2
			Total	**16**	**1**	**6**	**420**	**180**	**600**	**17**

SECOND SEMESTER

Sl. No.	Category	Course Code	Course	L	T	P	Exam	CA	Total	Credits
1	BS-IV	00BS201	Engineering Mathematics-II	4	-	-	75	25	100	3
2	BS-V	00BS202	Applied Physics-II	4	-	-	75	25	100	3
3	BS-VI	00BS203	Applied Chemistry II	4	-	-	75	25	100	3
4	ES-I	00ES204	Basic Engineering*	4		-	75	25	100	3
5	HS-II	00HP205	Communication Skills and Language Laboratory	-	2	3	60	40	100	4
6	BS-I Lab	00BP206	Applied Physics Laboratory	-	-	3	60	40	100	2
7	BS-II Lab	00BP207	Applied Chemistry Laboratory	-	-	3	60	40	100	2
8	ES-III Lab	00SP208	Engineering Workshop	-	2	3	60	40	100	4
			Total	**16**	**4**	**12**	**540**	**260**	**800**	**24**

* Basic Civil Engg. Course for Mech., Manuf., EEE, EIE, ECE, CSE & IT.

Basic Electrical Engg. Course for Civil, Civil and Structural, Mech., Manuf. & Chem. Engg.

Basic Mechanical Engg. Course for Civil, Civil and Structural, EEE, EIE, ECE, CSE, IT & Chem. Engg.

L - Lecture; T-Tutorial; P-Practical.

Exam - End Semester Examination; CA-Continuous Assessment.

Sl. No.	Category	Course Code	Course	L	T	P	CA	EXAM	Total	Credits
S E M E S T E R – III										

.	HS-III	00HS301	Environmental Studies	4	-	-	25	75	100	3
.	BS-VII	00BS302	Engineering Mathematics III	4	1	-	25	75	100	4
.	ES-II	00ES303	Engineering Mechanics	4	-	-	25	75	100	3
.	ES-III	04ES304	Material Science	4	-	-	25	75	100	3
.	PC-I	04PC305	Machine Tool Technology	4	-	-	25	75	100	3
.	PC-II	04PC306	Engineering Metrology	4	-	-	25	75	100	3
.	ES-IV Lab	04SP307	Electrical & Electronics Lab	-	-	3	40	60	100	2
.	PC-I Lab	04CP308	Mechanical Lab	-	-	3	40	60	100	2
			Total	**24**	**1**	**6**	**230**	570	**800**	**23**

S E M E S T E R – IV										
1.	BS-VIII	04BS401	Probability, Random Process and Numerical Methods	4	1	-	25	75	100	4
2.	ES-IV	04ES402	Thermodynamics	4	-	-	25	75	100	3
3.	PC-III	04PC403	Industrial Management	4	-	-	25	75	100	3
4.	PC-IV	04PC404	Engineering Metallurgy	4	-	-	25	75	100	3
5.	PC-V	04PC405	Metal Joining Processes	4	-	-	25	75	100	3
6.	PC-VI	04PC406	Metal Machining Processes	4	-	-	25	75	100	3
7.	PC-II Lab	04CP407	Machine Drawing	-	-	3	40	60	100	2
8.	PC-III Lab	04CP408	Strength of Materials Lab	-	-	3	40	60	100	2
			Total	**24**	**1**	**6**	**230**	570	**800**	**23**

S E M E S T E R – V										
1.	PC-VII	04PC501	Kinematics and Dynamics of Machinery	4	1	-	25	75	100	4
2.	PC-VIII	04PC502	Industrial Engineering	4	-	-	25	75	100	3
3.	PC-IX	04PC503	Casting Technology	4	-	-	25	75	100	3
4.	PC-X	04PC504	Computer Integrated Manufacturing Systems	4	-	-	25	75	100	3
5.	PE-I	04PE505	Professional Elective-I	4	-	-	25	75	100	3
6.	PE-II	04PE506	Professional Elective-II	4	-	-	25	75	100	3
7.	PC-IV Lab	04CP507	Machine Shop and Foundry Practice	-	-	3	40	60	100	2
8.	PC-V Lab	04CP508	Metrology and Measurements lab	-	-	3	40	60	100	2
9.	PE-I Lab	04EP509	Professional Elective-I Lab	-	-	3	40	60	100	2
			Total	**24**	**1**	**9**	**270**	630	**900**	**25**

Sl. No.	**Category**	**Course Code**	**Course**	**L**	**T**	**P**	**CA**	**EXAM**	**Total**	**Credits**
S E M E S T E R – VI										
1.	PC-XI	04PC601	Production & Operation	4	-	-	25	75	100	3

			Management							
2.	PC-XII	04PC602	Metal Forming Processes	4	-	-	25	75	100	3
3.	PE-III	04PE603	Professional Elective-III	4	-	-	25	75	100	3
4.	PE-IV	04PE604	Professional Elective-IV	4	-	-	25	75	100	3
5.	PE-V	04PE605	Professional Elective-V	4	-	-	25	75	100	3
6.	OE-I	XXOE606	Open Elective-I	4	-	-	25	75	100	3
7.	PC-VI Lab	04CP607	Metallurgy and Material Processing Lab	-	-	3	40	60	100	2
8.	PC-VII Lab	04CP608	Finite Element Analysis Lab	-	-	3	40	60	100	2
9.	PE-II Lab	04EP609	Professional Elective-II Lab	-	-	3	40	60	100	2
			Total	**24**	**-**	**9**	**270**	**630**	**900**	**24**

Sl. No.	Category	Course Code	Course	L	T	P	S	CA	EXAM	Total	Credits
S E M E S T E R – VII											
1.	HS-IV	00HS701	Engineering Ethics	4	-	-	-	25	75	100	3
2.	PC-XIII	04PC702	Operations Research	4	-	-	-	25	75	100	3
3.	PE-VI	04PE703	Professional Elective-VI	4	-	-	-	25	75	100	3
4.	PE-VII	04PE704	Professional Elective-VII	4	-	-	-	25	75	100	3
5.	OE-II	XXOE705	Open Elective-II	4	-	-	-	25	75	100	3
6.	PC-VIII Lab	04CP706	Special Machines Lab	-		3	-	40	60	100	2
7.	PE-III Lab	04EP707	Professional Elective-III Lab	-	-	3	-	40	60	100	2
8.	S & IT	04ST708	Seminar / Industrial Training	-	-	-	1	40	60	100	1
			Total	**20**	**-**	**6**	**1**	**245**	**555**	**800**	**20**

Sl. No.	Category	Course Code	Course	L	T	P	CA	EXAM	Total	Credits
S E M E S T E R – VIII										
1.	OE-III	XXOE801	Open Elective-III	4	-	-	25	75	100	3
2.	OE-IV	XXOE802	Open Elective-IV	4	-	-	25	75	100	3
3.	Proj.	04PV803	Project Work and Viva-voce	-	-	15	40	60	100	14
			Total	**8**		**15**	**90**	**210**	**300**	**20**

L-Lecture; T-Tutorial; P-Practical; D-Drawing

FE- Final Examination; CA-Continuous Assessment.

SYLLABUS

FIRST SEMESTER

00HS101	TECHNICAL ENGLISH	L	T	P
		4	0	0

COURSE OBJECTIVES

- English technical communication focuses on developing the proficiency of Engineering students in communicative skills, ensuring them to face the demand of their profession with high command in English.
- At the end of the course, the learners will be able to use English for all purposes of technical communication and come out in "flying colours".

UNIT–I : Listening Strategies

This unit makes the students to get exposed to the listening exercises and get registered in their minds the nuances of listening and its importance.

1. Listening process
2. Types of listening
3. Barriers to listening
4. Characteristics of good listeners
5. Team listening and note making

UNIT–II : Critical Reading and Creative Writing Skills

This unit introduces communication model like courtesy, body language, role play and good presentation in an effective manner, where the students are given an opportunity to observe, analyze, interpret, imagine and implement their ideas too.

Poem : Road not taken – Robert Frost
Ulysses – Alfred Lord Tennyson

Prose : Of Studies – Francis Bacon
Science – Destroyer or creator – J. Bronowski

Play : Pygmalion – Bernardshaw

UNIT–III : Speaking Skill

Students shall be motivated to speak in English on familiar or unfamiliar topics. It is a platform to train the students to achieve competency in oral expression.

1. Interview Techniques
2. Group discussion
3. Making presentation and Discussing on the presentation.
4. Sample interviews
5. Dialogue writing

UNIT–IV : Professional Writing

Students shall be trained to create their own proficiency in writing like - calling for quotation, asking clarification, placing orders and so on.

1. Poster making
2. Letter writing (formal and E-mail)
3. Analytical writing
4. Format of memos
5. Report Writing

UNIT–V : Theoretical Writing

The nuances of English grammar may be taught to the students so as to present flawless English both in their oral and written communication

1. Vocabulary – Homonyms, Homophones, Acronyms & Abbreviations, Idioms & Phrases
2. Single word substitution
3. Concord
4. Tag Questions
5. Active voice and passive voice

TEXT BOOK

1) Rizvi, Ashraf.2006. *"Effective Technical Communication"*. New Delhi. Tata McGraw Hill Publication Company Ltd.

REFERENCE BOOKS

1) Raman, Meenakshi and Sangeetha Sharma.2004. *"Technical Communication: Principles and Practice"*. New Delhi: OUP.
2) Bailey, Stephen. "*Academic Writing: A practical guide for students*". New York: Rutledge.2011.
3) Gerson, Sharon J and Steven M. Gerson. 2007. "*Technical writing: Process and Product*". Delhi: Pearson Prentice Hallan, 1980.

COURSE OUTCOMES

1) Understand the role of speaking in English and its contribution to their success.
2) Help the students increase the lingual power and word power, and frame suitable structures to use appropriately in different contexts.
3) Initiate the students to adopt different strategies for personal and professional writing.
4) Train the students use diversified rhetorical functions of technical English.

00BS102	ENGINEERING MATHEMATICS - I	L	T	P
		4	0	0

COURSE OBJECTIVES

To acquaint the student with the concepts in

- matrices,
- differential calculus,
- multiple integrals,
- Vector calculus, which are most important in connection with practical engineering problems.

UNIT–I : Matrices

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem – Orthogonal transformation of a real symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT–II : Differential Calculus

Curvature in Cartesian and parametric co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

UNIT–III : Differential Calculus: Functions of Several Variables

Jacobians – Taylor's and Maclaurin's series expansions of functions of two variables – Maxima and Minima of functions of two variables – Constrained Maxima and Minima by Lagrange Method.

UNIT–IV : Multiple Integrals

Double integration – Cartesian and polar co-ordinates – change of order of integration – area as a double integral – triple integration – Volume as a triple integral.

UNIT–V : Laplace Transform

Definition, Transform of elementary functions, Properties, Derivatives and integrals of transforms, Transforms of derivatives, Convolution theorem, Transforms of periodic functions,Inverse Laplace transform, Application to solution of linear ordinary differential equations of second order with constant coefficients.

(In all units, proof of theorems are not included).

TEXT BOOKS

1) Venkataraman M K, Engineering Mathematics, Volumes I (2008) and II (2009), The National Publishing Company, Chennai.
2) Veerarajan T, Engineering Mathematics, Second Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

REFERENCE BOOKS

1) Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 40th Edition, 2007.
2) Erwin Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 8th Edition, 2002.

COURSE OUTCOMES

1) This course equips students to have knowledge and understanding in matrices, differential calculus, multiple integrals and Laplace transforms.
2) Students will be able to solve problems related to above fields in engineering applications.

00BS103	APPLIED PHYSICS – I	L	T	P
		4	0	0

COURSE OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications

- Determine the different modulus of elasticity and viscosity of the less and highly viscous liquids.
- Design of acoustically good buildings.
- Interferometric techniques in metrology, communication and civil engineering.
- Application of quantum physics to optical and electrical phenomena.
- Application of ultrasonics and acoustics.
- Structure identification of engineering materials.
- Applications of Radio isotopes and power reactor systems.

UNIT–I : Properties of Matter

Introduction to elasticity - Hook's law - Different modulii of elasticity - Bending of beams – Determination of Young's modulus by Uniform and Nonuniform bending – I-shapegirder – Torsional pendulum - Theory – Experiment and its applications. Introduction to Viscosity – streamline and turbulent flow – Poiseuille's equation-capillary flow method – Stoke's law – terminal velocity – determination of viscosity by Stoke's method.

UNIT–II : Sound

Introduction to Acoustics - factors affecting acoustics of buildings and their remedies– absorption coefficient– Sabine's formula for reverberation time.

Introduction to Ultrasonics – production – magnetostriction and piezo electric methods – Detection of Ultrasonic waves (Acoustics grating) – Applications.

UNIT–III : Optics

Interference – Air wedge – Michelson's interferometer – Diffraction - Dispersive power of prism and grating – Polarisation – Types of Polarisation - theory of plane, Circularly and elliptically polarized light – photo elasticity -Stress optic law – Effect of a stressed model in plane polariscope – Isoclinic and Isochromatic fringes – photo elastic bench – uses.

UNIT–IV : Crystal Physics

Lattice - Unit cell - Bravais lattice - Atomic radius, co-ordination number, Packing factor and their calculations of SC,BCC,FCC and HCP crystal structures - Miller indices - Crystal imperfections (Point defect, Line defect, surface defect and volume defect).

UNIT–V : Nuclear Physics

Introduction - General properties of Nucleus – Mass defect, Binding energy, Nuclear models – Liquid drop model and Nuclear shell model - Nuclear detector – G.M counter – Scintillation Counter – Ionisation Chamber – Fission, Fusion, Thermonuclear reaction and Stellar energy – Nuclear reactor – General nuclear reactor – Breeder nuclear reactor.

TEXT BOOKS

1) Arumugam M., "Engineering Phyisics", Anuradha Agencies, Kumbakonam, 2000.
2) Gaur R.K. and Gupta S.L., "Engineering Physics", DhanpatRai Publishers, New Delhi, 2003.

REFERENCE BOOKS

1) Pillai S.O., "Solid State Physics", New Age International Publication, New Delhi, Seventh Edition, 2015.
2) Palanisamy P.K. "Physics for Engineers", Scitech Publication (India) Pvt. Ltd., Chennai, Second Edition, 2005.
3) Mani. P. "Engineering Phyisics", Dhanam Publication, Chennai, 2011.
4) Rajendran V. and Marikani A., "Applied physics for engineers", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.
5) Theraja B.L, "Modern Physics", Chand & company Ltd. , Edition 1990.

COURSE OUTCOMES

Upon completion of the course, students will be able to

1) Gain basic knowledge in the field of optics, sound, nuclear physics and crystalline materials etc.
2) Provide the foundation for solving engineering problems.

00BS104	APPLIED CHEMISTRY – I	L	T	P
		4	0	0

COURSE OBJECTIVES

To make the student conversant with the

- Water treatment techniques and disinfection methods.
- Working principle of electrochemical cells.
- Sources, refining and various types of fuels.
- Mechanism, classification, applications of lubricants and introduction adhesives.
- Surface chemistry, principle and applications of chromatography.

UNIT–I : Water Treatment

Water – Hardness of water – softening of water by ion-exchange process and zeolite process – boiler feed water – specifications – boiler troubles (Sludge and scale formation, priming and foaming, caustic embrittlement and boiler corrosion) – removal of dissolved CO_2, O_2 and acids – internal treatment of boiler feed water (colloidal, carbonate, phosphate, calgon and EDTA conditioning) – disinfection of water – break point chlorination – desalination of brackish water by reverse osmosis method - Determination of total hardness by EDTA method.

UNIT–II : Electro Chemistry

Electrochemical cell – EMF – determination of EMF of electrochemical cell – single electrode potential – standard electrode potential – Nernst equation – reference electrodes – standard hydrogen electrode, calomel electrode, glass electrode – electrochemical series – concentration cell.

UNIT–III : Fuels and Combustion

Classification of fuels – calorific value – HCV and LCV – Analysis of coal – proximate and ultimate analysis – carbonization of coal (HTC and LTC) – Manufacture of coke – properties of coke – flue gas analysis by Orsat's apparatus. Petroleum – Refining – Synthetic petrol – Fischer – Tropsch and Bergius process – cracking – polymerization process – knocking in petrol and diesel engines – octane number and cetane number – properties of straight run, cracked and polymer gasoline.

UNIT–IV : Engineering Materials – I

Lubricants and their functions – Mechanisms of lubrication – classification of lubricants with example – lubricating oils – properties of lubricating oils (viscosity index, flash and fire points, cloud and pour points, oiliness, carbon residue and aniline point) – Solid lubricants – Greases – emulsion lubricants. Adhesives – Definition – adhesive action – development of adhesives strength – physical and chemical factors influencing adhesive action – bonding process of adhesives – adhesives for building and constructions – animal glues, casein glues.

UNIT–V : Analytical Technique and Surface Chemistry

Chromatography – Definition – classifications – partition chromatography and adsorption chromatography.

Surface chemistry – Definition – types of adsorption – characteristics of adsorption – adsorption isotherms – Freundlich's adsorption isotherms and Langmuir's adsorption isotherms – applications of adsorption.

TEXT BOOKS

1) Sivasankar. B (2012). 'Engineering Chemistry', Tata McGraw-Hill Publishing company Limited, NewDelhi.
2) Sivakumar. R. and Sivakumar. N. (2013). 'Engineering Chemistry', Tata McGraw-Hill Company Limited, New Delhi.

REFERENCE BOOKS

1) Jain. P.C. and Monica Jain (2010)., 'Engineering Chemistry', DhanpatRai& Sons, New Delhi
2) Dara. S.S. and Umare. S.S. (2014). 'Text book of Engineering Chemistry,' S. Chand& Co. Ltd., New Delhi.
3) Gopalan. R, Venkappayya. D. and Nagarajan. S (2008). 'Engineering Chemistry', Tata McGraw Hill Publishing Company Limited, New Delhi.

COURSE OUTCOMES

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

1) Understand and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2) Understand and apply the concepts of electrochemistry including electroplating.
3) Understand the properties, sources of fuel and the concept of combustion
4) Gain the knowledge about types of lubricants, uses & their mechanisms and to understand the binding process of adhesives, and its application in building and construction.
5) Separate and purify various organic and inorganic compounds using different chromatographic techniques.
6) Understand the concept of surface chemistry and its applications.

00SP105	COMPUTER PROGRAMMING LABORATORY	L	T	P
		0	1	3

COURSE OBJECTIVES

- To enable the students to have a good understanding about the concepts of "C" programming.
- To provide the hands on experience in basic concepts of AUTOCAD to students.

C Programs Based on the Following Concepts

Basic structure of C Programs – Constants – Variables - Data Types - – Keywords – Identifiers - Operators - Expressions – IF, IF-ELSE, Nested IF-ELSE, Switch, WHILE, DO, FOR and GOTO statements - Arrays: one dimensional and two dimensional – Strings - Functions.

AutoCAD

Introduction – Terminology – Coordinates - Operations – Control keys – Commands – Utility Commands –File Commands – Edit and Inquiry Commands – Display Control Commands – Modes – Layers – Colors – Blocks.

Special Features – Dimensioning – Angular, Diameter and Radius – Hatching – Patterns – Slides – Attributes – Configuring – Plotting– Exercises in AUTOCAD (2D Drawings only).

TEXT BOOKS

1) E. Balagurusamy, Programming in Ansi C, Tata McGraw Hill Education, (2012) 6th Edition.
2) Cheryl R. Shrock, AutoCAD Pocket Reference, BPB Publications, (2015).

REFERENCE BOOKS

1) Yashavant P. Kanetkar, Let us C, BPB Publications, 14th Edition, (2016).
2) David Byrnes, AutoCAD 2010 FOR DUMMIES, Wiley Publishing,Inc., (2010).

COURSE OUTCOMES

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

1) Understand the concepts of C programming.
2) Apply the syntax of conditional and looping statements for writing C programs
3) Use the features of AUTOCAD for 2D drawing.

00SP208	ENGINEERING GRAPHICS	L	T	P
		2	0	3

COURSE OBJECTIVES

- To develop the ability to produce simple engineering drawing and sketches based on current practice.
- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others though drawing.
- To develop the skills to read manufacturing and construction drawings used in industry.
- To develop a working knowledge of the layout of plant and equipment.
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators.
- To expose the international standards of technical drawing.

UNIT–I

Introduction to Engineering Drawing, Use of drafting instruments– Lettering and dimensioning. Construction of conic sections -Ellipse, Parabola & Hyperbola (Eccentricity Method, Rectangle method, Intersecting arcs method) - Special curves- Simple cycloids and involutes– Tangent and normal at points on the curves only.

UNIT–II

Orthographic projections - Projections of Points- Projections of Straight lines (given the projections, to determine the true length and true inclinations).

UNIT–III

Projections of Solids like prism, pyramid, cylinder, cone, tetrahedron and octahedron in simple positions.

Auxiliary Projections of prism, pyramid, cylinder, cone when the axis is inclined to one plane only.

UNIT–IV

Sections of prism, pyramid, cylinder, cone in simple position – true shape of sections.Intersection of surfaces - cylinder to cylinder and cylinder to cone with axis intersecting at right angles. Development of lateral surfaces of prism, pyramid, cylinder, cone and cut solids.

UNIT–V

Isometric Projections of simple solids and combinations. Perspective Projections of simple solids. Conversion of Pictorial view of simple objects into Orthographic views.

TEXT BOOKS

1) Bhatt, N.D Engineering Drawing - Charotar Book Stall, Anand – 388001.
2) Venugopal, K., Engineering Drawing and Graphics, New Age International (P) Ltd., Publishers, Chennai.

REFERENCE BOOKS

1) Gopalakrishna, K.R., Engineering Drawing, Vol. I and Vol. II, Subhas Stores, Avenue Road, Bangalore – 560002.
2) Kumar, M.S., Engineering Graphics, DD Publications, Chennai – 6400048.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

1) Construct, read, and understand the Title and Revision Block
2) Enhance the usage of common drafting tools to construct engineering drawings
3) Apply dimensions on engineering drawing.
4) Convert sketches to engineered drawings.
5) Develop cognitive and psychomotor skills, visualize images and their dimensions
6) Develop good communication skills and team work.

SECOND SEMESTER

00BS201	ENGINEERING MATHEMATICS II	L	T	P
		4	0	0

COURSE OBJECTIVES

- To acquaint the student with the concepts in ordinary differential equations and vector calculus.
- To acquaint the student with the techniques in the theory of analytic functions and complex integration.

UNIT–I : Ordinary Differential Equations

Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients (Euler and Legendre's linear equations), Simultaneous first order linear equations with constant coefficients, method of variation of parameters.

UNIT–II : Vector Differentiation

Gradient, divergence and curl, directional derivative, unit normal vector, irrotational and solenoidal vector fields, expansion formulae for operators involving ∇.

UNIT–III : Vector Integration

Line, surface and volume integrals, Green's theorem in a plane, Gauss divergence theorem, Stoke's theorem – Verification of the above theorems and evaluation of integrals using them.

UNIT–IV : Analytic Functions

Functions of a complex variable, Analytic function, the necessary conditions (Cauchy-Riemann equations), sufficient conditions, Properties of analytic functions, harmonic functions, construction of Analytic function by Milne-Thomson method, Conformal mapping: $w = z^2$, $1/z$, e^z, sin z, cos z.

UNIT–V : Complex Integration

Statement and application of Cauchy theorem, Cauchy integral formulas, Taylor and Laurent expansion, Singularities – Classification; Residues – Statement and application of Cauchy residue theorem, Contour integration round the unit circle.

(In all units, proof of theorems are not included)

TEXT BOOKS

1) Venkataraman, M.K., Engineering Mathematics, Volumes I (2008) and II (2009), The National Publishing Company, Chennai.
2) Veerarajan, T., Engineering Mathematics, Second Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

REFERENCE BOOKS

1) Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 40th Edition, 2007.
2) Erwin Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 8th Edition, 2002.

COURSE OUTCOMES

Upon completion of the course, students

1) Equip have knowledge and understanding in ordinary differential equations, vector calculus and complex variables.
2) Able to solve problems related to above fields in engineering applications.

00BS202	APPLIED PHYSICS – II	L	T	P
		4	0	0

COURSE OBJECTIVES

At the end of the course the students would be exposed to fundamental knowledge in various materials and applications

- Application of lasers and fiber optics in engineering and technology.
- Astrophysics is the study of physics of the universe. In various objects, such as stars, planets and galaxies.
- To measure positions, brightness, spectra structure of gas clouds, planets, starts, galaxies, globular clusters, quasars etc.
- Physics of modern engineering materials.

- Electromagnetic phenomena and wave propagation
- Applications of nano materials, nano electronics and optoelectronic devices.
- Design of energy sources and applications of solar energy.

UNIT–I : Laser and Fiber Optics

Introduction to laser - Einstein co-efficients (A&B) – properties of Laser- Types of laser – CO_2, Nd: YAG and Semiconductor lasers - Applications – Holography - Construction and reconstruction of hologram - Applications.

Fiber optics - Principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - Types of optical fibers (Material, Mode and refractive index) - Applications - Fiber Optic communication system.

UNIT–II : Dielectrics and Superconductors

Introduction to Dielectrics – Types of Dielectric materials - Dielectric constant – Determination of Dielectric constant ($\sum r$) by Schering Bridge method – Different types of polarization – Local or Internal field – Clausius-Mosotti Equation – Dielectric Loss – Dielectric breakdown – Dielectric Properties and applications – Superconductivity – Properties – Meissner effect – Type I and Type II superconductors – BCS theory- High temperature Superconductors – Applications.

UNIT–III : Nano Materials

Introduction to Nanomaterials – properties – Types of nanomaterials – synthesis of nanomaterials - Top-down approaches – Mechanical grinding, Lithiography – Types of Lithiography - Bottomup approaches – physical vapour deposition method, Sol-gel method. Applications of nanomaterial. Carbon Nanotubes (CNT) – Introduction – Types of Carbon Nanotubes – Synthesis of Carbon Nanotubes – Properties and its application.

UNIT–IV : Quantum Mechanics

Heisenberg uncertainty Principle - Wave particle dual nature – De Broglie's matter Waves – wave Velocity and group velocity.

The wave Equation, Schrödinger's Time dependent wave equation, Schrödinger's time independent wave equation - The Wave function and its physical significance - The particle in a box – energy quantization – Eigen values and Eigen functions.

UNIT–V : Energy Physics

Introduction to energy source - Energy sources and their availability (Conventional &non-conventional energy sources) – Solar energy – Introduction – Methods of Harvesting Solar energy (Solar cells, Solar battery, Solar heat collectors and Solar water heater) - Wind energy – basic components of a WECS (Wind Energy Conversion System) – Classification of WEC Systems – Advantages and disadvantages of WECS - Biomass – Biomass conversion - Biogas Generation - Classification of Biogas plants.

TEXT BOOKS

1) Arumugam.M. "Engineering Physics", Anuradha Agencies, 2nd Edition, 1997.
2) Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2003.

REFERENCE BOOKS

1) Rajendran. V., "Engineering Physics", Tata McGraw Hill Publishers, 2009.
2) Rai G.D., "Non-conventional Energy Sources", Khauna Publications, 1993.
3) Martin Harwit, "Astrophysical Concepts", Springer, 4th Edition, 2006.
4) Dimitri Mihalas. "Stellar Atmospheres", San Francisco, W.H, Freeman & Company, 1978.
5) Wilson M., Kannangara K., Smitt G., Simmons M. & Boguse B. "Nanotechnology", Basic Science and Emergine Technology, Raguse Chapman hall Publications, 2002.

COURSE OUTCOMES

At the end of the course, the students

1) Possesses the theoretical knowledge in the field of laser, dielectrics, Nano technique, energy physics etc.
2) Able to solve problems in their respective fields of engineering.

00BS203	APPLIED CHEMISTRY II	L	T	P
		4	0	0

COURSE OBJECTIVES

To make the students to understand the

- Types of polymers and polymerization processes.
- Phase rule with different kinds of systems.
- Different types of corrosion and their mechanism.
- Working principle and applications of primary and secondary batteries.
- Engineering materials such as refractories and abrasives.

Unit–I : Polymers

High polymers: plastics – Thermoplastics and thermosetting resins. Addition polymerization and condensation polymerization – compounding of plastics – Moulding methods – Compression, injection and blow moulding – Important engineering plastics – polyethylene, PVC, Teflon, Polystyrenes, Nylon 6,6, Bakelite, Polyurethane – Rubber – natural rubber – vulcanization of rubber – Synthetic rubber – buna-S, butyl rubber, neoprene and polyurethane foams.

Unit–II : Phase Rule

Phase rule – statements and explanation of the terms involved – condensed phase rule – construction of phase diagram – water system – sulphur system – phase rule for two component alloy systems – thermal analysis – eutectic system – Lead-Silver system – simple eutectic formation – Zinc – Magnesium alloy system.

Unit–III : Corrosion and Prevention

Corrosion: Dry and wet corrosion – Pilling-Bedworth rule – mechanism of wet corrosion – types of wet corrosion – galvanic corrosion – differential aeration corrosion – factors affecting corrosions. Corrosion control methods – design and material selection – cathodic protections – sacrificial anode and impressed current method – corrosion inhibitors – protective coatings – surface preparations – Galvanizations, Tinning – electroplating – anodizing, phosphate coating, hot dipping.

Unit–IV : Energy Storage Devices

Types of battery – commercial voltaic cell – primary battery – secondary storage cell – lead – acid cell, nickel-cadmium cell, lithium battery – fuel cells – hydrogen-oxygen fuel cell – photovoltaic cell – principle, working and applications.

Unit–V : Engineering Materials II

Refractories – classification (acidic, basic and neutral refractories) – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – fire clay bricks, alumina bricks and zirconia bricks. Abrasives – Moh's scale of hardness – natural abrasive (diamond, corundum, emery, garnets and quartz) – synthetic abrasives – silicon carbide, boron carbide and their uses.

TEXT BOOKS

1) Sivasankar. B (2012)., 'Engineering Chemistry', Tata McGraw-Hill Publishing company Limited, NewDelhi.
2) Sivakumar. R and Sivakumar. N (2013)., 'Engineering Chemistry', Tata McGraw-Hill Company Limited, NewDelhi.

REFERENCE BOOKS

1) Jain. P.C. and Monica Jain (2010)., 'Engineering Chemistry', DhanpatRai& Sons, New Delhi
2) Dara. S.S. and Umare. S.S (2014)., 'Text book of Engineering Chemistry', S. Chand & Co. Ltd., New Delhi.
3) Gopalan. R, Venkappayya. D, and Nagarajan. S (2008)., 'Engineering Chemistry', Tata McGraw Hill Publishing Company Limited, New Delhi.
4) Gowariker. V.R., Viswanathan N.V. and Jayadev Sreedhar, (2006)., 'Polymer Science', New Age International P (Ltd.,), Chennai. (Unit I)
5) Puri. B.R, Sharma. L.R & Pathania. M.S. (2013)., 'Principles of Physical Chemistry', Vishal Publishing Company, New Delhi. (Unit II).

COURSE OUTCOMES

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

1) Understand the synthesis and applications of various types of polymers and moulding processes.
2) Understand the concept of phase rule and its applications, which is applicable in alloy preparation.
3) Understand the concept of corrosion and to apply the knowledge in the protection of different metals from corrosion.
4) Gain the knowledge about various energy storage devices, especially solar energy.
5) Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.
6) Gain knowledge on classification, synthesis and applications of abrasives and refractories.

00ES204	BASIC ENGINEERING (CIVIL)	L	T	P
		2	0	0

COURSE OBJECTIVES

- To inculcate a knowledge on essentials of Civil Engineering.
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying societal needs.
- To illustrate the concepts of various construction techniques.

Unit–I

Introduction to Civil Engineering - various disciplines of Civil Engineering, relevance of Civil Engineering in the overall infrastructural development of the country. Introduction to various building materials – Stone, Bricks, Steel, Cement, Concrete, Timber – its characteristics, types and uses. Various types of buildings as per nbc; Selection of suitable site for buildings, Components of a residential building – its functions, Orientation of a building, simple definitions - plinth area / built up area, floor area / carpet area – floor space index.

Unit–II

Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances – chain – compass: Introduction to Leveling, Total station, Remote sensing - fundamental principles and applications.

Building construction – foundations; Bearing capacity of soil, functions of foundations, Types - Shallow and Deep. Brick masonry – Header, Stretcher, Flemish and English Bond. Columns, Lintels, Roofs – functions, types, roofing materials, Floors – functions, types, flooring materials. Decorative finishes – plastering, interior design.

Unit–III

Bridges – necessity - selection of site – components of a bridge: Dams – types – selection site - forces acting on a dam – Roads – uses - classification of roads – components of a road; Railways – basic components of permanent way – water supply – per capita requirement – sources – need for conservation of water – rain water harvesting - basic water treatment – Sewage and its disposal – basic definitions – Septic tank - components and functions.

TEXT BOOKS

1) Ramesh Babu. V, A Text Book of Basic Civil Engineering, Anuradha Agencies, Kumbakonam, 1995.
2) Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company ltd, 2000.

REFERENCE BOOKS

1) Ramamrutham, V., Basic Civil Engineering, Dhanpat Rai Publishing Co. (P) Ltd., 1999.
2) Natarajan K.V., Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
3) Satheesh Gopi, Basic Civil Engineering, Pearson Publications, 2010.

COURSE OUTCOMES

Upon completion of the course students will be able to

1) Understand the basic knowledge on civil engineering materials
2) Develop the skill to satisfy the social needs
3) Describe the suitable construction technique

00ES204	BASIC ENGINEERING (ELECTRICAL)	L	T	P
		2	0	0

COURSE OBJECTIVES

- To impart the basic principles of generation of electrical energy.
- To explain the operation of electrical machines and various measuring instruments.
- To understand the basic concepts of circuit analysis.
- To provide an overview of the principles, operation and application of semiconductor devices like diodes, BJT, FET and a basic knowledge of fundamentals of Communication Systems.

UNIT–I

Sources of Electrical energy–Generation of electrical energy – working principles of DC generators and alternators– Advantages of electrical energy over other forms of Energy.

Operating principle of DC motors– Types of DC motors– Characteristics and uses of DC motors. Working principles of Single and Three phase transformers. Operating Principle of three phase and single phase induction motors– types and uses of induction motors.

Working principles of MC and MI voltmeters and Ammeters, Dynamo meter type wattmeter, Induction type energy meter and Multimeter–types of wiring– requirements for house wiring–typical layout for a small house– earthing.

UNIT–II

DC Circuits: Definition of current, voltage, power and energy– DC voltage and current sources– resistance, types of resistors, series and parallel connections of resistors, current and voltage division–loop method of analysis of simple circuits.

AC Circuits: Sinusoidal signals – average, r.m.s values –inductance, capacitance and their V–I relationships. Analysis of simple single phase series circuits– power and power factor–phasor diagrams– Introductions to three phase AC circuits.

UNIT–III

Basic Electronics: Principle and characteristics, uses of PN junction Diode, Zenerdiode, BJT, FET, UJT, Thyristors,- Operating principle of Half wave, Full wave and Bridge rectifiers.

Digital Electronics and Principles of Communication Systems: Symbol, truth table and functions of basic logic gates, universal gates, Half adder, Full adder. Communication systems–Microwave, Satellite, Fibreoptic and ISDN (block diagram description only).

TEXT BOOKS

1) Nagrath, I.J., 2007. Elements of Electrical Engineering, 2nd Edition, 14th reprint, Tata McGraw Hill Publishing Co. Limited, New Delhi.

REFERENCE BOOKS

1) Gupta, B.R., 2002. Principles of Electrical Engineering, S. Chand & Co, New Delhi.
2) Theraja. B.L & Theraja. A.K., 2000. Electrical Technology, Vol. I, II, and IV, S. Chand and Co., New Delhi.

3) Floyd & Jain, 2009. Digital Fundamentals, 8th Edition, Pearson Education.
4) Anok Singh, 2006. Principles of Communication Engineering, 6th reprint, S. Chand & Company Ltd., Ram Nagar, New Delhi.

COURSE OUTCOMES

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

1) Provide comprehensive idea about simple circuit analysis, working principles of machines and common measuring instruments
2) Analyze the behavior of any DC and AC circuits
3) Characterize semiconductor devices like diodes, BJT and digital functions.
4) Understand the fundamental principles of communication systems.

00ES204	BASIC ENGINEERING (MECHANICAL)	L	T	P
		2	0	0

COURSE OBJECTIVES

- To familiarize the functioning of different types of Boilers, the mountings and accessories.
- To provide basic knowledge about the use of various machine tools and the basic principles of welding, brazing and soldering.
- To illustrate the concepts of various metal forming operations and metal joining techniques.

UNIT–I

Boilers: Classification – Description and working of Simple vertical boiler, Cochran boiler, Babcock and Wilcox boiler - Description and working of boiler mountings: water level indicator, Pressure gauge, Dead weight and Spring loaded Safety value, Fusible plug, Feed check value, Steam stop value and Blow–off cock - Description and working of boiler accessories: Economiser and Super heater.

UNIT–II

Prime Movers: Steam turbines: Principles and working of Impulse and Reaction turbines – Comparison. Gas turbines: Principles and working of Open cycle and Closed cycle gas turbines. Internal Combustion Engines: Classification – principal parts – comparison of two strike and four stroke engines – working principle of petrol and diesel engines.

UNIT–III

Machine Tools: Description of parts and operations performed – Lathe, Shaper and Drilling machine.

Metal Forming: Hot working versus cold working; Hand forging – Principle and operations; Rolling – Principle, rolling mill configurations; Extrusion – Direct versus indirect extrusion.

Metal Joining: Gas welding – principle, Oxy-acetylene welding – equipment, types of flames, advantages and disadvantages – Arc welding - principle, advantages and disadvantages – Brazing – Torch brazing, dip brazing, furnace brazing, resistance brazing – Soldering – Comparison of brazing and soldering.

TEXT BOOKS

1) Prabhu T.J., Jaiganesh V. and Jebaraj S., Basic Mechanical Engineering, Scitech Publications Pvt. Ltd., Chennai, 2000.
2) Venugopal and Prabhuraj T.J., Basic Mechanical Engineering, ARS publishers, Sirkali, 1996.

REFERENCE BOOKS

1) Hajra Choudhury S.K., Nirjhar Roy, Hajra Choudhury A.K., Elements of Workshop Technology, (Vol 1 and Vol II,) , Media Promoters, Pvt Ltd. (2008).
2) Rao P. N., Manufacturing Technology : Foundry, Forming and Welding - Vol 1, McGraw Hill Education, (2013).
3) Steven R. Schmid, Serope Kalpakjian, Manufacturing Processes for Engineering Materials (English) 5th Edition, Pearson India, (2009).

COURSE OUTCOMES

Upon completion of the course, students will be able to

1) Understand the construction and working principles of boilers.
2) Distinguish steam and gas turbines.
3) Select suitable manufacturing methods to produce a new component.

00HS205	COMMUNICATION SKILLS AND LANGUAGE LABORATORY	L	T	P
		0	2	3

COURSE OBJECTIVES

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

Theoretical Session (Internal Assessment Only)

1) English sound pattern
2) Sounds of English
3) Pronunciation
4) Stress and Intonation
5) Situational Dialogues/ Role play
6) Oral presentations- Prepared or Extempore
7) 'Just a Minute' sessions (JAM)
8) Describing Objects /situations/ people
9) Debate
10) Giving Directions

Practical Session

- To make the students recognize the sounds of English through Audio Visual Aids
- To enable the students speak fluently without fear
- To develop their communicative skill with individual practice through the prescribed package

- The Globarena Package consists of the following exercises
  1. Reading comprehension
  2. Listening comprehension
  3. Vocabulary exercises
  4. Phonetics
  5. Role Play in dialogues
  6. Auto Speak

REFERENCE BOOKS

1) Globarena Package for communicative English
2) Cambridge Advanced Learner's English Dictionary
3) Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
4) English Pronouncing Dictionary Daniel Jones Current Edition with CD.
5) Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.

Distribution and Weightage of Marks

English Language Laboratory Practical Paper:

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 40 sessional marks and 60 year-end Examination marks. 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.

COURSE OUTCOMES

1) Help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such as GRE, TOEFL, GMAT, etc.
2) Train the students to use language effectively to face interviews, group discussions, and public speaking.
3) Initiate the students into greater use of the computer in resume preparation, report writing, format-making, etc

00BP206	APPLIED PHYSICS LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES

The ability to offer students a variety of research opportunities

- To determine the radius of curvature of the plano convex lens and the wavelength of the sodium light by measuring the diameter of Newton's rings.
- We can use a spectrometer to measure this angle of deviation.
- To measure the modulus of elastic material by torsional pendulum and bending of a beam.
- To determine the resistivity of a given steel and brass wire.
- To find the velocity of ultrasonic waves in a liquid.
- Less viscosity of the liquid by poiseuille's method.

List of Experiments (Any Ten)

1) Non-Uniform Bending - Determination of Young's modulus of the given scale or beam.
2) Newton's rings - Determination of Radius of curvature of the given Plano convex lens.
3) Viscosity – Determination of co-efficient of Viscosity of a highly viscous liquid by Stoke's method.
4) Spectrometer – Dispersive power of a given prism.
5) Torsional Pendulum – Determination of Moment of Inertia of the metallic disc and
6) Rigidity Modulus of the material of a wire.
7) Field along the axis of a coil- Determination of horizontal earth magnetic flux density.
8) Air wedge – Determination of thickness of a given thin wire and paper.
9) Viscosity - Determination of co-efficient of Viscosity of a less viscous liquid by Capillary flow method
10) Uniform bending- Determination of Young's modulus of the given scale or beam.
11) Spectrometer – Determination of wavelength of the prominent spectral lines using Grating.
12) Semiconductor diode laser – Determination of wavelength of Laser source using Grating.
13) Band gap determination of a Semiconductor.

COURSE OUTCOMES

Upon completion of the course, students will be able to

1) Determine resistivity of a given steel and brass wire.
2) Find the velocity of ultrasonic waves in a liquid.
3) Measure the thickness of thin materials.
4) Determine the band gap of a given semiconductor.
5) Understand the applications of opto electronic devices

00BP207	APPLIED CHEMISTRY LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES

- To appreciate the practical significance of acidimetry, alkalimetry and permanganometry
- To analyse quantitatively the amount of a substance present in a given sample.
- To assess the composition of an alloy
- To test the water quality standards.

List of Experiments

1) Estimation of Potassium hydroxide
2) Estimation of Acetic acid in vinegar

3) Estimation of Temporary hardness of water sample
4) Estimation of Total hardness of water sample
5) Estimate separate amount of sodium carbonate and sodium hydroxide in a mixture.
6) Estimation of Ferrous sulphate
7) Estimation of Mohr's salt
8) Estimation of ferrous iron
9) Estimation of Oxalic acid
10) Determination of available free chlorine in a water sample.
11) Estimation of copper in brass by iodometry
12) Estimation of iron by dichrometry
13) Estimation of nickel in an alloy

COURSE OUTCOMES

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

1) Gain knowledge in the quantitative chemical analysis of water quality related parameters, acid-base, red-ox and iodometry titrations.

00SP106	ENGINEERING WORKSHOP	L	T	P
		0	0	3

COURSE OBJECTIVES

- To provide the students simple hands-on-experience in the basic aspects of production engineering in fitting, carpentry and sheet metal.

Workshop Practice in the Shops

Carpentry: Use of hand tools – exercises in planning and making joints namely, half lap joint, dovetail joint, mortising and tenoning.

Fitting: Use of bench tools, vice, hammers, chisels, files, hacksaw, centre punch, twist drill, taps and dies – Simple exercises in making T joint and dovetail joints.

Sheet Metal Work: Use of hand tools – Simple exercises in making objects like cone, funnel, tray, cylinder.

Smithy: Demonstration of hand forging and drop forging.

COURSE OUTCOMES

Upon completion of this course, students will be able to

1. Use basic tools of fitting, carpentry and sheet metal fabrication.
2. Fabricate simple carpentry joints.
3. Develop skill to make simple fitting joints.
4. Create simple shapes of sheet material.
5. Distinguish hand forging and drop forging operation.

DEPARTMENT OF MANUFACTURING ENGINEERING

VISION

To prepare students to be life-long learners and global citizens with successful careers in design, research, development, and management of systems in manufacturing and service organizations.

MISSION

- A curriculum and educational experience designed and continuously improved through involvement and contribution of students, faculty, administrators, staff, and industry.
- A well-focused research program funded at the local, regional, and national level.
- A demonstrated competence and expertise in addressing the needs of industry and community at large.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. The graduates acquire ability to create model, design, synthesize and analyze essential production operational skills, mechanism and automation system.
2. The graduates use their talent, self-confidence, knowledge and engineering practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths.
3. The graduates apply their consciousness of moral, professional responsibilities and motivation to practice life-long learning in a team work environment.

PROGRAM OUTCOMES (PO)

Upon Completion of the four years of the Bachelor of Mechanical Engineering (Manufacturing) Degree.

PO1: INTEGRATION OF KNOWLEDGE

Graduate will demonstrate strong basics in mathematics, science, engineering and technology which serve as the foundation for the Programme.

PO2: PROBLEM ANALYSIS

Graduate will demonstrate the ability to design and conduct experiments, as well as to analyze and interpret data in the spheres of fundamental engineering.

PO3: DESIGN AND DEVELOPMENT OF SOLUTIONS

Graduate will demonstrate the 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.

PO4: USE OF MODERN TOOLS AND TECHNIQUES

Graduate will become familiar with modern engineering tools and analyse the problems within the domains of Manufacturing Technology as the members of multidisciplinary teams.

PO5: COLLABORATIVE AND MULTIDISCIPLINARY APPROACH

Graduate will acquire the capability to identify, formulate and solve engineering problems related to manufacturing engineering in interdisciplinary and multidisciplinary sciences.

PO6: ETHICAL PRACTICES AND SOCIAL RESPONSIBILITIES

Graduate will demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of manufacturing engineering.

PO7: COMMUNICATION SKILLS

Graduate interact with engineering community and with society at large, regarding intricate engineering activities on technical perspectives and emerge as an efficient motivator. He will be able to communicate effectively both in verbal and non verbal forms.

PO8: PROJECT MANAGEMENT

Graduate will be able to design and develop innovative / manufacturable / marketable / environmental friendly products useful to the society and nation at large. Graduate will be able to manage any organization well and will be able to emerge as a successful entrepreneur.

PO9: LIFE LONG LEARNING

Graduate will be capable of understanding the value for life long-long learning, in the context of technological challenges.

Mapping of PO with PEO			
POs	**PEO1**	**PEO2**	**PEO3**
PO1	✓	✓	
PO2	✓		
PO3	✓		
PO4	✓		
PO5		✓	
PO6		✓	✓
PO7		✓	✓
PO8		✓	✓
PO9		✓	✓

PE-PROFESSIONAL ELECTIVES

1) Mechanics of Materials.
2) Electrical & Electronics Engineering.
3) Machine Tool Control.
4) Tool Engineering.
5) Design of Machine Elements.
6) Machine Tool Design.
7) Non Traditional Manufacturing Processes.
8) Advanced manufacturing processes.
9) Surface Engineering.
10) Non Destructive Testing.

PE-LAB

1) CAD/CAM Lab.
2) Mechatronics and CNC Lab.
3) Hydraulics Lab.
4) Computing and Simulation Lab.

OE-OPEN ELECTIVES

1) Fluid Mechanics & Machinery.
2) Mechatronics for Automation.
3) Computer Aided Product Design.
4) Total Quality Management.
5) Engineering Economics.
6) Sensors and Control Systems in Manufacturing.
7) Automotive Engineering.
8) Biology for Engineers.
9) Disaster Management.
10) Entrepreneurship.
11) National Service Scheme.
12) Human Rights.

THIRD SEMESTER

00HS301	ENVIRONMENTAL STUDIES	L	T	P
		4	0	0

UNIT–I

Introduction - Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness.

Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their 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, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. 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

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 - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT–III

Introduction – Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots 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

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

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.

UNIT V

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 ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

TEXT BOOKS

1) Agarwal, K.C. 2001. Environmental Biology, Nidi Publ. Ltd. Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)

REFERENCE BOOKS

1) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
3) Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p.
4) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5) Down to Earth, Centre for Science and Environment (R).
6) Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p.
7) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).

8) Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
9) Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
10) Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
11) Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
12) Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
13) Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
14) Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
15) Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
16) Survey of the Environment, The Hindu (M)
17) Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
18) Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)
19) Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)

00BS302	ENGINEERING MATHEMATICS - III	L	T	P
		4	0	0

COURSE OBJECTIVES

- The students will be trained on the basics of chosen topics of mathematics, namely, partial differential equations, Fourier series, Boundary value problems, Fourier transform and Z-transform.
- The above topics introduced in this course will serve as basic tools for specialized studies in engineering.

UNIT–I : Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

UNIT–II : Fourier Series

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

UNIT–III : Boundary Value Problems

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT–IV : Fourier Transform

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity

UNIT–V : Z-Transform and difference equations

Z-transform – Elementary properties – Inverse Z-transform - Convolution theorem – Solution of difference equations using Z-transform.

TEXT BOOKS

1) Kandasamy, P., Tilagavathy, K., and Gunavathy, K., "Engineering Mathematics", 6th Edition, (Vol. I & II), S. Chand & Co Ltd., New Delhi, 2006.
2) Ventakataraman, M.K., "Engineering Mathematics", The National Publishing Co., Chennai, 2003.

REFERENCE BOOKS

1) Veerarajan, T., "Engineering Mathematics", 3rd edition, Tata McGraw Hill Pub, 2005.
2) Singaravelu, A., "Engineering Mathematics", Meenakshi Publications, Chennai, 2004.

COURSE OUTCOMES

1) Students would acquire basic understanding of the most common partial differential equations and to learn some methods of solving them
2) Students would acquire basic understanding of the Fourier series, Fourier transform and Z-transform and to learn some methods of solving them.
3) The students should be able to solve some boundary value problems.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓			✓				
CO2	✓	✓			✓				
CO3	✓	✓			✓				

00ES303	**ENGINEERING MECHANICS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the fundamentals of forces and their effects with their governing laws.
- To understand the definitions of particle, body forces and their equilibrium conditions.
- To understand and predict the forces and its related motions.

UNIT-I : Statistics of Particles

Introduction – Units and Dimensions - Laws of Mechanics – Lami's Theorem – Parallelogram, Triangular and Polygon Law of forces – Classification of Forces – Vectorial Representation of Forces – Coplanar Forces – resolution of Forces.

Equilibrium of Particle – Vector representation of Space Force – Equlibrium of Particle in Space – Equivalent System of Force – Principle of Transmissibility.

UNIT–II : Equilibrium of Rigid Bodies

Free body diagram – Types of supports – types of loads – Types of beams – Action and reaction of force – Moments and cuples – Moment of a dforce – Vectorial representation of moments and couples.

Varignon's theorem – Stable equilibrium – Single equilavent force – equilibrium of rigid bodies in two dimensions and three dimensions.

UNIT–III : Geometrical Properties of Surfaces and Solids

Centroid and centre of gravity – Dtermination of centroid of sections of different geometry – Centre of gravity of a body – Area moment of inertia – Parallel axis theorem – perpendicular axis theorm – Determination of moment of intertias of rectangular, triangular, circular and semi-circular – Moment of inertias of structural steel sections if standard and composite sections.

Polar moment of inertia – Radius of gyration – Principal moment of inertia – Mass moment of inertia – Determination of mass moment of inertia of a thin rectangular plate, thin circular disc, solid cylinder, prism, sphere and cone from first principles.

UNIT–IV : Dynamics of Particles

Introduction – Kinematics and kinetics – Displacements, velocity and acceleration – Equations of motion – types of motion – Rectilinear motion – Relative motion – Curvilinear motion – Ptrojectiles.

Newton's laws of motion – Linear momentum – impulse and momentum-D's Alembert's principles – Dynamics equilibrium – Work energy equations – Law of conservation of energy – Principles of work and energy.

UNIT–V : Friction and Elements of Rigid Body Dynamics

Friction force – Laws of sliding friction – Equlibrium analysis of simple syustems with sliding friction – Wedge friction.

Rolling resistance – Translation and rotation of rigid bodies- Velocity and acceleration – General motion of simple rigid bodies such as culinder, disc/wheel and sphere.

TEXT BOOKS

1) Palanichamy, M.S., and Nagan, S., (2010) Engineering Mechanics (Statics and Dynamics), Tata McGraw Hill Publishing Company Ltd., New Delhi.
2) Beer, F.P. and Johnson, R., (2004) Vector Mechanics for Engineer (Statics), McGraw Hill Book Company, New Delhi.
3) Natesan, S.C., (2002), Engineering Mechanics, (Statics and Dynamics), First Edition, Umesh Publications, New Delhi.

REFERENCE BOOKS

1) Bhavikatti, S.S. and K.G. Rajasekarappa, (1999). Engineering Mechanics, New Agent Internationsl (P) Ltd.
2) Sadhu Sing, (2000). Engineering Mechanics, Oxford & IBH Publishing Co., New Delhi.
3) Irving H. Shames, (2006). Engineering Mechanics, Prentice Hall of India Ltd., New Delhi.

4) Hibbeller, R.C. and Ashok Gupta, (2010). Engineering Mechanics: Statics and Dynamics, Edition, Pearson Education.
5) Vela Murali, Engineering Mechanics.

COURSE OUTCOMES

Students can able

1) To explain the forces and its related laws of mechanics in static and dynamic conditions.
2) To analyse the forces and its motion on particles, rigid bodies and structures.
3) To solve the moment of inertia of any sections and masses for the structural members.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2	✓	✓							
CO3	✓	✓							
CO4	✓		✓						

04ES304	**MATERIAL SCIENCE**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

To impart fundamental knowledge on the structure of Engineering Materials,

- To impart knowledge about characteristics of polymer, ceramic and metal matrix composite materials.
- To impart knowledge about magnetic characteristics of engineering materials.

UNIT–I

Unit cell, Crystal systems, BCC, FCC & HCP structures, Crystallographic planes & direction, Miller indices, Crystal imperfections - point, line & area defects. Constitution of alloys, compounds & solid solutions, Gibbs phase rule, lever rule.

UNIT–II

Introduction – Processing of plastic materials – Thermo plastics – Thermosetting plastics – Elastomers – applications - Materials selection for engineering designs using plastic materials.

UNIT–III

Introduction – Traditional and engineering ceramics – Electrical properties of ceramics – Mechanical properties of ceramics – Thermal properties of ceramics – Glasses – applications.

UNIT–IV

Introduction – Fiber reinforced plastic composite materials - Fibers and matrix materials – Concrete – Asphalt and asphalt mixes – Wood – Sandwich structures – Metal matrix and ceramic matrix composites-applications. Natural Fiber and Natural Polymer based Composite materials - Introduction

UNIT–V

Types of magnetism – Magnetization and Demagnetization of ferromagnetic metal – Soft magnetic materials – Hard magnetic material – Ferrites – applications.

Semiconductor materials – Conductor and resistor materials – Super conducting materials - Die electric materials – applications.

TEXT BOOKS

1) William F. Smith., "Principles of Materials Science and Engineering", Third Edition, McGraw Hill, Inc., 1996.

REFERENCE BOOKS

1) Kenneth. G. Budinski, Michael K. Budinski, "Engineering Materials Properties and Solution", 6th Edition, Prentice Hall International, 1999.
2) Higgins, R.A., "Properties of Engineering Materials", Viva low priced student edition, 2nd Edition, 1998.
3) Raghavan, V., "Materials Science and Engineering", Prentice Hall of India, 1991.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the basic structures of Engineering materials
2) Impart fundamental knowledge about Polymer composites;
3) Use Bio degradable materials for the future will keep the environment clean
4) Implement Fiber based composites results in high industrial productivity

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2		✓							
CO3				✓				✓	✓
CO4			✓						

04PC305	**MACHINE TOOL TECHNOLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the different types and functions of metal cutting machine tools.
- To provide in depth knowledge about various machine tools and operating procedures.
- To illustrate different mechanisms used in metal cutting machines.
- To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

UNIT–I

Lathe: Specifications of centre lathe - operations performed - accessories and attachments - principle of capstan and turret lathes - layout of tools.

Shaper, Planner and slotter: General arrangement - principle of operation - drive mechanisms.

UNIT–II

Milling machine: Types - specification - operations - types of cutters - attachments and accessories - examples of work.

Drilling and Boring: Types - specification of drilling machines - operations - accessories and attachments - types of boring machines - jig boring.

Sawing: Power saws - types and principle of operation.

UNIT–III

Purpose – classification – surface finish – applications – grinding wheel – types – specifications – selection – surface grinding machine – block diagram – functions of each part – cylindrical grinding – Centreless grinding – Comparison – infeed, end feed and through feed. Balancing, dressing, loading and Truing of wheel.

UNIT–IV

Overview of NC, CNC and DNC –CNC System – Constructional features of CNC machines - Machining center – Turning center – Turn mill center. Drives – Transmission belting – axial feed drives – slideways – feedback devices. Work and Tool holding devices.

UNIT V

Manual part programming – sample programs:Turning, milling, drilling and face milling –Computer aided part programming – languages – geometric statements - point to point program – programming the tool path – mission commands – Simple examples of APT programming.

TEXT BOOKS

1) Suresh Dalela, "Manufacturing Science & Technology", Vol. I & II, Umesh Publications, 1997.
2) Radhakrishnan, P., "Computer Numerical control of Machine Tools", New Central Book Agency, 2002.

REFERENCE BOOKS

1) Jain, R.K., "Production Technology", Khanna Publications, New Delhi, 1995.
2) Hajra Choudhry, S.K., "Elements of Workshop Technology", Media Promoters & Publications Pvt. Ltd, 1994.
3) HMT Hand Book, "Production Technology", Tata McGraw-Hill Publication Co. Ltd, 1996.
4) Kalpakjian, S., "Manufacturing Engineering & Technology", 3rd Edition, Addition Wesley Inc. 1997.
5) Kumar, B., "Manufacturing Technology", Khanna Publishers, New Delhi, 2000.
6) Jonathan Lin. S.C., "Computer Numerical Control from Programming to Networking", Delmar Publishers, 3rd Edition 2009.
7) Krar, S.F., and Check, A.F., "Technology of Machine Tools", Tata McGraw-Hill, New Delhi, 1998.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Know the different types of operations with necessary tools.
2) Understand the mechanisms and their settings involved in appropriate machine tool.
3) Differentiate single point and multi point cutting tools and machines.
4) Obtain knowledge about advanced machine tools.
5) Gain and apply the knowledge of CNC machines and programming

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**

CO1	✓	✓							
CO2	✓	✓	✓	✓	✓				
CO3		✓	✓		✓				
CO4		✓		✓	✓				
CO5	✓	✓	✓	✓					

04PC306	**ENGINEERING METROLOGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the basic principles of measurements.
- To introduce the various methods of measuring mechanical parameters.
- To learn about advancements in measurement and automation.

UNIT–I : Concept of Measurement

General concept - Generalised measurement system - Units and standards - Measuring instruments: sensitivity, stability, range, accuracy and precision - static and dynamic response - repeatability - systematic and random errors - correction, calibration - Introduction to Dimensional and Geometric Tolerancing - interchangeability.

UNIT–II : Linear and Angular Measurement

Definition of metrology - Linear measuring instruments: Vernier, micrometer, Slip gauges and classification,-Tool Maker's Microscope-interferometer, optical flats,-Comparators: limit gauges Mechanical, pneumatic, electrical and differential comparators - applications. Angular measurements: Sine bar, Sine center, bevel protractor, Auto Collimators and Angle Decker.

UNIT–III : Form Measurement

Measurement of screw threads: Thread gauges, floating carriage micrometer-Measurement of gear tooth thickness: constant chord and base tangent method - Gleason gear testing machine - Radius measurements - surface finish: equipments and parameters, straightness, flatness and roundness measurements.

UNIT–IV : Measurement of Mechanical Parameters

Measurement of force, torque, power: - mechanical, pneumatic, hydraulic, electrical types and Strain gauges - Pressure measurement – Flow measurement: Venturi, orifice, rotameter, pitot tube – Temperature measurement: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor and Alignment tests for machine tools.

UNIT–V : Laser and Advances in Metrology

Precision instruments based on laser - Principles-laser interferometer - application in measurements and machine tool metrology - Coordinate Measuring Machine (CMM): Need, construction, types, applications. In process control with computer aided inspection - Machine vision system - fundamentals and applications.

TEXT BOOKS

1) Jain, R.K., "Engineering Metrology", Khanna Publishers, 2005.
2) Alan, S., Morris, "The Essence of Measurement", Prentice Hall of India, 1997.

REFERENCE BOOKS

1) Gupta, S.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2) Jayal, A.K., "Instrumentation and Mechanical Measurements", Galgotia Publications, 2000.
3) Beckwith, Marangoni, and Lienhard, "Mechanical Measurements", Pearson Education, 2006.
4) Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the basics of measurements and know various linear, angular, form measuring equipments- their principle of operation and applications.
2) Select appropriate measuring instrument for a required mechanical parameter to a specific application.
3) Know about modern measuring equipments for a production industry.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2	✓			✓	✓				
CO3		✓							

04SP307	**ELECTRICAL AND ELECTRONICS LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To train the students about the operation of basic electrical machines.
- To explain the students about the operation of simple electronic circuits.

LIST OF EXPERIMENTS

1) Load test on DC shunt motor.
2) Speed control of DC shunt motor.
3) Load test on single phase transformer.
4) Load test on three phase transformer.
5) Load test on single phase induction motor.
6) Measurement of three phase power using two watt meter method.
7) Half wave and full wave rectifiers with capacitor filter.
8) Characteristics of Transistors.

COURSE OUTCOMES

1) Acquire the characteristics of simple electronic circuits.
2) Develop the skill to operate simple electrical machines.
3) Obtain the characteristic curves of electric machines.
4) Experience the speed control methods of motors.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						
CO2	✓		✓						✓
CO3	✓	✓							
CO4	✓	✓		✓					

04CP308	MECHANICAL ENGINEERING LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES

- To study the components of I.C. engines, boilers, steam turbines and steam engines.
- To provide practical training on governors, flywheel, cam and follower, balancing and vibration.

LIST OF EXPERIMENTS

1) Study and valve timing on four stroke diesel engine.
2) Study and port timing on two stroke petrol engine.
3) Load test on four stroke diesel engine.
4) Performance test on air compressor.
5) Experimental verification of natural frequency in natural vibration of single rotor system.
6) Determine the characteristic curves of watt/ Hartnell governors.
7) Determination of mass moment of inertia of connecting rod and fly wheel.
8) Studies on cam and follower mechanism.

COURSE OUTCOMES

Upon completion of this practical class, the students will be able to:

1) Understand the various types of engines and dynamometers working principle.
2) Know the dismantling and assembling procedure for four stroke CI engines.
3) Understand the concepts of displacement, velocity and acceleration as vectors and how to determine them.
4) Ability to analyze particle dynamics.
5) Ability to make a right decision related to a choice of the system of particles whose motion is to be studied.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓					
CO2	✓	✓							
CO3	✓	✓		✓					
CO4	✓	✓							
CO5	✓							✓	✓

FOURTH SEMESTER

04BS401	PROBABILITY, RANDOM PROCESSES AND NUMERICAL METHODS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce the probability, random processes, and statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
- To develop the skills of the students in numerical mathematics - using method of finite difference interpolation.
- Finding numerical solution of algebraic and transcendental equations.
- Finding numerical solution of ordinary and partial differential equations.

UNIT–I : Probability and Random Variables

Definition – Types of random variables - probability distribution function - probability density function – expectation and moments – moment generating functions –joint probability distribution -marginal probability distribution function – joint probability density function – marginal probability density function – conditional probability density function.

UNIT–II : Random Processes

Classification of random processes – methods of description of a random process – special classes of random processes – Average values of random process - stationarity –Autocorrelation function and its properties - cross correlation function and its properties.

UNIT–III : Test of Significance

Hypothesis, testing – Large sampling tests – small sampling test based on t, F and chi-square distributions – interval estimates of mean, standard deviation and proportion.

UNIT–IV : Interpolation, Numerical Differentiation and Integration

Interpolation: Gregory Newton forward and backward interpolation formula; Stirling's central difference formula; Lagrange's interpolation formula for unequal interval.

Numerical differentiation: Using Newton's forward and backward interpolation formula.

Numerical integration: Trapezoidal rule, Simpson's one-third and three-eight rules.

UNIT–V : Solution of Algebraic, Transcendental and Ordinary Differential Equations

Solution of algebraic and transcendental equations: Bolzano's bisection method, Regula-falsi method, Newton–Raphson method.

Solution of simultaneous algebraic equation: Gauss elimination method, Crout's method, Gauss – Seidel iteration method.

Solution of ordinary differential equations: Taylor series method, Runge–Kutta fourth order method, Milne's - Predictor corrector method.

TEXT BOOKS

1) Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Probability and random processes", S. Chand & Co. Ltd.
2) Veerarajan, T., "Probability theory and Random Process", Tata McGraw-Hill Co. Ltd, New Delhi, 2005.

REFERENCE BOOKS

1) Lipschutz, S., and Schiller, J., "Schaum's Outlines – Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.
2) Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Numerical Methods", S. Chand & Co. Ltd., New Delhi, 2004.
3) Venkataraman, M.K., "Numerical Method in Science and Engineering", National Publishing Co., Chennai, 2003.

COURSE OUTCOMES

At the end of the course, the students would.

1) Understand the concept of algebraic and transcendental equations.
2) Acquire skills in handling situations involving random variables, random processes.
3) Solve problems for engineers in using numerical methods.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓					
CO2	✓	✓		✓					
CO3	✓	✓		✓	✓				

04ES402	**THERMODYNAMICS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the basic concepts and laws of thermodynamics.
- In depth knowledge of topics in thermal engineering like internal combustion engines, air compressors, steam turbines, refrigeration and air conditioning, and modes of air heat transfer.

UNIT–I

Thermodynamics - Definition - heat and work - open system and closed system - state, property and change of state of a system - properties of vapor - internal energy - entropy, dryness fraction - Calorimeter for determination of dryness fraction.

UNIT–II

Internal Combustion Engines Cycles of operation - Otto, Diesel and Semi-diesel - calculation of air standard efficiency and relative efficiency - Indicator diagram - Power and Mechanical efficiency - performance curves - heat balance - problems.

UNIT–III

Air compressors: Reciprocating air compressor - single and multistage compression - inter cooling - calculation of main dimensions - Effect of clearance volume - Volumetric efficiency.

UNIT–IV

Steam Cycles Rankine cycle with reheating and regenerating, feed heating, steam turbines - details - compounding of turbine - velocity diagram - blade efficiency - reaction turbine - height of blade and diameter of drum.

UNIT–V

Heat transfer Primary modes of heat transfer - basic laws of conduction, convection and radiation - simple problems - refrigeration and air-conditioning - General principles of refrigeration - C.O.P calculations of psychometric chart - air conditioning methods.

(Use of Steam tables, Mollier chart and Psychrometric chart are permitted).

TEXT BOOKS

1) Nag, P.K., "Engineering Thermodynamics", Tata McGraw Hill Publishing Company Limited, New Delhi, 1991.
2) Ballaney, P.L., "Thermal Engineering", Khanna Publishers Delhi, 1991.

REFERENCE BOOKS

1) Domkundwar, S., "A Course in Thermodynamics and Heat Engines", Dhanpat Rai and Sons, New Delhi, 1989.
2) Mathur, M.L., and Sharma, R.P., "Internal Combustion Engines", Dhanpat Rai & Sons, New Delhi, 1992.
3) Saravanan, C.G., and Ashok, M.P., "Thermodynamics", SciTech Publications, 2008.
4) Arora, C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, 1994.

COURSE OUTCOMES

Upon completion of this course, the students will be able to understand:

1) Fundamental concepts and definitions, Thermodynamic principles to Engineering Applications.
2) To study the fundamentals properties of steam, gas and gas mixtures.
3) Functioning and performance of IC engines.
4) Principles of refrigeration and air conditioning.
5) Modes of heat transfer and basic laws.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓		✓					✓
CO2	✓	✓	✓						✓
CO3	✓		✓						
CO4	✓	✓	✓						✓
CO5	✓	✓							✓

04PC403	INDUSTRIAL MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce the students to different functional areas of industrial management including engineering economics and Organizational behaviour.

UNIT–I : Engineering Economics

Engineering economics - nature and scope of managerial economics - basic economic tools in managerial economics - decision and efficiency analysis. Consumer behaviour - law of demand and supply - elasticity - determinants - uses. Pricing under different market conditions: Monopoly - monopolistic competition -

oligopoly, pricing policies - Porter's five forces - model of competition. Financial markets: Primary and secondary markets - money market instruments - capital market instruments. National income - concepts. Trade and development: Free trade versus protection - balance of payments - globalisation - W.T.O.

UNIT–II : Organizational Behaviour

Organizational Components to be Managed - Individual Behaviour: Governing factors - Determinants of personality. Motivation – Importance – Theories: Maslow's Theory of Need Hierarchy - Theory X and Theory Y - techniques of motivation. Job satisfaction – Governing factors – Effects. Group Dynamics - Development of Inter-personal Relationship. Group Behaviour - Group cohesiveness. Conflict - Functional and Dysfunctional Conflict - Conflict resolution model. Stress – Sources – Management of Stress. Leadership – Types –Theories: Hersey and Blanchard's situational leadership model - Path-Goal theory.

UNIT–III : Elements of Management

Principles of management - Functions of management - Scientific management: Contributions of Taylor, Gilberth, Gant t-Forms of business organisation - line, functional, line and staff organisations - Industrial ownership: single, partnership, joint stock company, co-operative organisations, state and central government owned.

Costing

Objectives - Elements of costs - estimation of selling price, Allocation of overheads - Introduction to activity based costing.

UNIT–IV

Break-even analysis - concept and applications - Depreciation - straight line and declining balance method. – Value analysis – Procedure.

Supply Chain management – basic concepts – Analytic hierarchy process.

UNIT–V

TPM – pillars of TPM – six big losses – TPM implementation. Just in Time (JIT) – value added focus – sources of waste – Toyoto's seven waste – waste reduction – push pull system – Kanban theory – JIT implementation.

TEXT BOOKS

1) Kumar. B., "Industrial Engineering", Khanna Publications, 1995.
2) Govindarajan, M., and Natarajan, S., "Principles of Management", Prentice Hall of India Pvt. Ltd. New Delhi, 2007.
3) Jain, S.K., "Applied Economics for Managers and Engineers", Vikas Publishers, 1997.

REFERENCE BOOKS

1) Herald Koontz and Heinz Weihrich, "Essentials of Management", McGraw Hill Publishing Company, Singapore International Edition, 1980.
2) "Mechanical Estimating and Costing", TTTI Madras, Tata McGraw Hill, 2003.
3) Mehta P.L., "Managerial Economics", Sultan Chand & Sons, 1995.
4) Vaish, M.C., "Money, Banking, Trade and Public Finance", New Age International (P) Ltd., 1996.
5) Ties, AF, Stoner and R. Edward Freeman, "Management", Prentice Hall of India Pvt. Ltd. New Delhi, 1992.
6) Chandran, S., "Organizational Behaviors", Vikas Publishing House Pvt. Ltd, 1994.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Recognise the factors such as demand and production for pricing criteria.
2) Understand and learn the effective interpersonal, team building and leadership skills.
3) Improved the organizational performance through the effective management of human resources.
4) Practice the process of management's four functions: planning, organizing, leading, and controlling.
5) Differentiate between the various types of organizational structures and patterns.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2				✓					
CO3		✓							
CO4				✓					
CO5				✓					

04PC404	**ENGINEERING METALLURGY**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To impart fundamental knowledge on the structure, properties, heat treatment, testing and applications of metals and alloys.
- To introduce the concept of powder metallurgy and different type of corrosion.

UNIT–I

Constitution of alloys, compounds & solid solutions, Gibbs phase rule, lever rule - Diffusion in Solids, Fick's laws – Solidification, Nucleation and grain growth - constitutional supercooling, formation of dendrites - Directional solidification, Micro segregation, Macro segregation, Porosity and inclusions - Metallography - metallurgical microscope - preparation of specimen, micro & macro examination. Grain size ASTM grain size number, grain size measurement.

UNIT–II

Phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron - Carbon equilibrium diagram - Classification of steel - Plain carbon steels - effect of C, Mn, Si, P & S. Purpose of alloying, effect of important alloying elements. - Important low alloy steels, stainless steel, tool steels - types, compositions and applications ; Cast iron - types, composition and applications.

UNIT–III

Heat treatment of steel: Isothermal transformation diagram - Time Temperature Transformation Diagram, Continuous cooling transformation diagrams, full annealing, stress relief annealing, spheroidzing, normalizing, Hardenability and Jominy end quench test- Austempering and martempering - case hardening, carburising, nitriding, cyaniding, and carbon nitriding, flame hardening, induction hardening, vacuum hardening and cryogenic treatment- Precipitation and Age hardening.

UNIT–IV

Non ferrous metals: Physical, Mechanical, Metallurgical properties of Aluminum alloys, Magnesium alloys, Copper alloys, Nickel alloys and Titanium alloys – Classification of these alloys and applications.

Powder metallurgy : Process fundamentals, production of metal powders, characteristics, powder blending, compacting, Sintering, applications.

Corrosion - Factors influencing corrosion, pitting corrosion, cavitation corrosion, cervice corrosion, fretting corrosion, inter - granular corrosion - corrosion prevention.

UNIT V

Mechanical behaviour of materials: Tensile behaviour: engineering stress, engineering strain, true stress, true strain, Stress – strain curve, Yield point phenomenon, strain aging. Impact behaviour: Charpy and Izod impact testing, DBT curve. Hardness: Brinell hardness, Rockwell hardness, micro hardness testing; Fatigue behaviour: Stress cycles, S-N curves, fatigue crack initiation, fatigue crack propagation; Creep behaviour: creep curve, creep mechanisms, deformation mechanism maps.

TEXT BOOKS

1) Sydney, H., Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Co., 2008.
2) Raghavan, V., "Materials Science & Engineering", Prentice Hall of India Pvt.Ltd, 2015.

REFERENCE BOOKS

1) George E. Dieter., "Mechanical Metallurgy", McGraw Hill Book Company, New York, 1988.
2) Rollason, E.C., "Metallurgy for Engineers", Butterworth-Heinemann Ltd, 4th Revised edition, 1987.
3) Williams, D., "Material Science and Engineering", Callister Wiley India Pvt. Ltd, Revised Indian edition, 2007.
4) Sinha, A.K., "Powder Metallurgy", Dhanpat Rai & Son, New Delhi, 1995.
5) Raj Narayan, "An Introduction to Metallic Corrosion & its Prevention", Oxford & IBH, New Delhi, 1983.
6) Higgins, R.A., "Engineering Metallurgy - Part I, Applied Physical Metallurgy", ELBS, 1993.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the correlation between structure and properties of metals and alloys.
2) Select the appropriate alloys for specific applications.
3) Design heat treatment methods for specific applications.
4) Protect the metals and alloys from environmental degradation.
5) Evaluate the mechanical properties of materials by modern tools and equipments.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓		✓				✓		
CO2		✓	✓		✓				
CO3			✓	✓					
CO4			✓					✓	
CO5				✓	✓			✓	✓

04PC405	METAL JOINING PROCESSES	L	T	P
		4	0	0

COURSE OBJECTIVES

- Apply knowledge of materials to prescribe appropriate welding process for specific applications.
- Model and simulate welding processes to conduct experiments and analyze the performance using modern tools.
- Understand the environmental issues related to each welding methods and try to develop 'green welding' methods.

UNIT–I

Basics of arc welding processes - Classification of welding and allied Processes - Welding arc: physics involved in arc, structure and characteristics, arc efficiency calculation, methods of arc initiation and maintenance, arc stability, arc blow - V-I characteristics, constant current and constant voltage characteristics, duty cycle, simple problems.

Arc Welding Power Sources: welding transformers, generators, rectifiers, inverters; Classsification of electrodes - Metal Transfer: forces affecting metals transfer - modes of metal transfer.

UNIT–II

Arc welding processes-Basic principles, Process variables, Chief characteristics and applications of the following processes: Shielded(Manual) Metal Arc Welding (SMAW/MMAW) - Submerged Arc Welding (SAW), Gas Tungsten Arc Welding (GTAW), Gas Metal Arc Welding (GMAW), CO_2 welding, Flux cored Arc Welding (FCAW), Electro Slag and Electro Gas Welding - Atomic Hydrogen Welding.

UNIT–III

Resistance welding processes Basic principle, Process variables, Welding Sequence, Process characteristics and applications of the following processes: Spot welding, simple problems - Seam welding - Projection welding - Percussion welding - Resistance Butt welding - Flash Butt welding - High Frequency Resistance Welding (HFRW) and High Frequency Induction Welding (HFIW).

UNIT–IV

Solid state welding processes, Basic principles, Process parameters, Process characteristics and applications of the following Processes: Friction welding – Friction stir welding - Explosive welding - Ultrasonic welding - Diffusion Bonding. Allied processes: Basic principles, Process variables, Chief characteristics and applications of the following processes: Electron Beam Welding (EBW) - Laser Beam Welding (LBW) - Thermit welding - Gas welding - Soldering - Brazing - Adhesive Bonding - Welding of plastics.

UNIT–V

Defects in welding in various processes - Causes and remedies; Ultrasonic dye penetrant, magnetic particle inspection. X ray testing procedures and identification of defects – case studies. Automation in welding – Seam tracking vision and arc sensing welding robots. Design of weldments-Welding symbols positions of welding joint and groove design. Weld stress – Calculations – Design of weld size.

TEXT BOOKS

1) Parmar, R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 2007.
2) Prasad, J., and Nair, C.G.K., "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Publishers, New Delhi, 2011.

REFERENCE BOOKS

1) Nadkarni, S.V., "Modern Arc Welding Technology", Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1996.
2) Khanna, O.P., "Welding Technology" Dhanpat Rai & Sons Publishers, New Delhi, 1993.
3) O'Brien, R.L., "Welding Hand Book, Welding Process", Vol. II, 8th Edition, American Welding Society, 1991.
4) Little, R.L., "Welding and Welding Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 1990.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the physics behind welding arc and heat flow equations.
2) Distinguish between fusion welding processes and solid state welding processes.
3) Select appropriate welding process for joining specific materials.
4) Inspect welding defects using Non-destructive testing methods.
5) Understand the environmental issues and safety requirements for each processes.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓							
CO2			✓						
CO3				✓					
CO4					✓				
CO5			✓						

04PC406	METAL MACHINING PROCESSES	L	T	P
		4	0	0

COURSE OBJECTIVES

- To know the Metal Cutting Process.
- To know the basic concepts of temperature developed during machining.
- To understand Tool Materials, Tool Life and Tool Wear.

UNIT–I

Tool Materials: HSS, Carbide and coated tools, CBN, Ceramic and PCD. Tool geometry - single point cutting tool and multi point cutting tool - Tool signature-Tool designation: ASM, DIN, British standards and their relationships.

UNIT–II

Metal Cutting Process: Chip formation - Types of chips - chip breakers- Chip thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut – Theories of formation of built-up edge and their effect - Chip formation in drilling and milling.

UNIT–III

Introduction to Orthogonal and Oblique cutting processes- The force system- Velocity relationship- forces in turning and milling- Relationship between forces, speed, feed and depth of cut- - Forces and energy calculations (Merchant's Analysis) Single Point Cutting Tool: Various systems of specifications, single point cutting tool geometry and their inter-relation.

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. Effect of machining parameter on tool life- measurement techniques for tool wear- Tool economics- basic concepts- simple problem.

UNIT–V

Thermal Aspects of Machining and Cutting Fluid: Regions of heat generation; Heat In the Primary Shear Zone, Heat at the Tool/work Interface, Heat Flow at the Tool Clearance Face, Average shear plane temperature; Average chip-tool interface temperature; method of tool temperature measurement, temperature distribution in tool, Cutting Fluid: Types and composition of cutting fluids, selection of cutting fluid.

TEXT BOOKS

1) Boothryd, "Fundamentals of Machining", Edward Amold Publishers Ltd, 1975.
2) David Son, LacainGoud, "Tool Design", Tata Me GrawHill.
3) Juneja. B.L. and Sekhon. G.S, "Fundamentals of Metal Cutting and Machine Tools", New Age International (P) Ltd., 2003.

REFERENCES BOOKS

1) Sehrawat, M.S., and Narang, J.S., "Metal Cutting Principles", Milton C Saw, Oxford.
2) M.C. Shaw, "Metal Cutting Principles", Oxford and IBH Publications, New Delhi, 1969.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Analyze the Tool Life and Tool Wear.
2) Understand basic concept of tools and tool materials.
3) Distinguish between Orthogonal and Oblique cutting.
4) Understand the concepts of thermal aspects of machining.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							✓
CO2	✓	✓							
CO3			✓		✓				
CO4		✓	✓	✓				✓	

04CP407	MACHINE DRAWING	L	T	P
		0	0	3

COURSE OBJECTIVES

- To provide basic understanding of machine drawing.
- To study the provide assembly and disassembly drawings of bearings, screw jack etc.

UNIT–I : Free Hand Sketches

Fasteners: Different form of rivet heads – Single, double riveted lap and butt joints - Foundation bolts - Locking arrangements for nuts - lock nut, split pin, locking plate and spring washer - Stud Set screws – Different forms of machine screws - pan, countersunk, slotted and philip headed screws - Keys - sunk taper key, gib headed taper key, feather key, woodruff key, saddle key.

UNIT–II : Orthographic and Assembly Drawings

To draw orthographic views from the given isometric views of simple objects. Detailed assembly drawing and additional views from the given drawing.

a. Shaft coupling - Protected type and Pin type flexible coupling
b. Bearings and Supports - Bushed bearing, Foot step bearing and Plummer Block
c. Eccentric
d. Steam engine stuffing box
e. Screw jack.

TEXT BOOKS

1) Gopalakrishna K.R., Machine Drawing, Subhas stores, Bangalore.
2) Bhatt N.D., Machine Drawing, Charotar Publishing House.

REFERENCE BOOKS

1) Parkinson A.C. (Sinha), A First Year Engineering Drawing, Wheeler Publishers, New Delhi.
2) Parkinson A.C., Intermediate Engineering Drawing.
3) Narayana K.L., Kanniah P. & Venkata Reddy K., A text book on Production Drawing, Premier Publishing House, Hydrabad.
4) Narayana K.L., Kanniah P. & Venkata Reddy K., Machine Drawing, New Age International (P) Limited, Publishers.
5) Lakshmi Narayanan V & Mathur M.L., A Text Book of Machine Drawing, Jain Brothers Publishers.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) An Ability to understand and apply the knowledge of machine drawing as a system of communication in which ideas are expressed clearly and all information fully conveyed.
2) An ability to understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability, economic, environmental, safety & sustainability etc.., to represent a part drawing and assembly drawings.

3) Recognition of the need for and an ability to engage in self education and life-long learning.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓					✓		
CO2	✓	✓					✓		
CO3	✓				✓				✓

04CP408	**STRENGTH OF MATERIALS LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To impart practical training on simple machines like screw jack, worm wheel, etc.,
- To understand the theoretical and practical aspects of elasticity and plasticity of the materials through a variety of experiments.

LIST OF EXPERIMENTS

1) Simple Machines - screw jack, worm and wheel, differential wheel and Axle, Handlowinch.
2) Material Testing - Tension, compression and shear tests on different materials
3) Bending and deflection test on beams.
4) Hardness, impact and ductility tests on metals.
5) Torsion tests on rods, springs and fatigue tests (Demonstration only).

COURSE OUTCOMES

Upon completion of the course the students will be able to

1) Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
2) Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
3) Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2	✓		✓						
CO3	✓	✓		✓					

FIFTH SEMESTER

04PC501	KINEMATICS AND DYNAMICS OF MACHINERY	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the different types of mechanism.
- To provide in depth knowledge about power loss in different types of bearings and clutches.
- To draw the turning moment diagram of reciprocating engines.
- To illustrate the different types of problem in balancing and vibration of rotating masses.
- To introduce as a tool for static and dynamic analysis of mechanisms for use in design and engineering.

UNIT–I

Kinematics – links- pairs, chain – mechanisms and inversions – velocity and acceleration of single slider crank chain by relative velocity method. Klein's construction for velocity and acceleration of single slider crank chain.

UNIT–II

Friction: frictional loss of power in journal, pivot and collar bearings. Clutches – single plate multiple plate and cone clutches. Belt and rope drives- ratio of tension-power transmitted.

UNIT–III

Turning moment: De Alembert's principle-inertia force, calculation of turning moment in reciprocating engines. Co-efficient of fluctuation of energy, coefficient of fluctuation of speed - fly wheels for punch press.

UNIT–IV

Balancing - static and dynamic balancing - Balancing of rotating masses, balancing of reciprocating masses – introduction to primary and secondary balancing.

UNIT–V

Vibrations: Damped and forced oscillations of single degree freedom systems – example - torsional oscillations of two rotor systems - whirling of shafts.

TEXT BOOKS

1) Ballaney, P.L., "Theory of Machines", Khanna Publishers New Delhi.
2) Khurmi, and Gupta, "Theory of Machines", Chand & Co.

REFERENCE BOOKS

1) Thomas Bevan, "Theory of Machines", Longman.
2) Abdulla Sheriff, "Theory of Machines", Danpat Rai & Co.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Know the different types of links and pairs in the kinematic chain.
2) Understand the power loss in friction for different types of clutches and bearings.

3) Obtain knowledge about the turning moment diagram for reciprocating engines.
4) Know the different types of balancing and vibration of static and dynamic system.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2	✓			✓					
CO3	✓		✓						
CO4	✓				✓				

04PC502	**INDUSTRIAL ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To impart basic knowledge to the students on the applications of industrial engineering.
- To provide basic knowledge about the plant, maintenance and work measurement and accessories.
- To provide an understanding of the traditional approaches for managing operations.

UNIT–I : Plant Location

Locational objectives - Factors influencing locational choice - Locational models - Dimensional analysis, breakeven model, qualitative factor rating method, Brown - Gibson model.

UNIT–II : Plant Layout

Need for layout planning - Layout objectives and determinants - Types of layout - Process, product, fixed position, group layout - Comparison - Layout selection for process layouts - Simple graphic approach, travel chart, load - distance analysis, Muthur - grid technique - computer based layout planning - CRAFT (Description only of algorithm and flowchart) - Line layouts for product layouts - Line balancing methods - Largest candidate rule, Kilbridge and Wester method - COMSOAL (Description of the algorithm only).

UNIT–III : Work Study

Structure and objectives of work study - method study - Basic procedure for method study - recording methods - process charts, multiple activity charts, - flow diagrams, SIMO chart, - Principles of motion economy. Work measurement : Basic procedure of work measurement - Time study - allowances, estimation of standard time - Work sampling.

UNIT–IV : Purchasing

Purchasing functions - Single versus multiple sourcing - Vendor performance rating - Methods - categorical plans, cost - ratio plan, weight point plan - Make - or - buy decisions - Learning curve - concepts and applications - Stores management - functions - Methods of pricing - FIFO, LIFO - Stores layout and location system - Classification and codification of materials in stores.

UNIT–V : Maintenance

Objectives - Forms of maintenance - Preventive, breakdown and corrective - Preventive and breakdown maintenance costs - spare parts planning - maintenance, insurance and capital spares.

TEXT BOOKS

1) Monks, G.J., "Operations Management", McGraw-Hill, 1987.
2) Chary, S.N., "Theory and Problems in Operations and Production Management" Tata McGraw Hill, 1994.

REFERENCE BOOKS

1) Buffa, E.S., and Sarin., R.K., "Modern Production/Operations Management", John Wiley, 1994.
2) Ray Wild, "Production and Operations Management - Principles and Techniques", ELBS.
3) ILO, "Introduction to Work Study", Oxford & IBH Pub. Co. New Delhi, 1991.
4) Adam, E.E., and Ebert, R., "Production and Operations Management", PHI, 1992.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the applications of Industrial Engineering.
2) Understand the need of maintenance in industry.
3) Understand the importance of plant location and layout.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2									
CO3				✓					

04PC503	CASTING TECHNOLOGY	L	T	P
		4	0	0

COURSE OBJECTIVES

- To impart about the sand casting process and its importance.
- The basic phenomena involved in metal casting process, gating and risering system.
- To introduce Modern casting methods.

UNIT–I

Sand: Moulding Sands- Properties- Additives used, Control of Moulding Sands. Moulding -Types of Moulding- Moulding Processes, Instruments used for different methods. Moulding Materials- Quality moulds- Dressing of moulds. Moulding machine.

Pattern: Types of Pattern - Pattern Materials - Pattern Allowances- Pattern Making Machinery. Core: Purpose of Cores- Preparation of Cores- Core Materials and Additions- Core Dressing, Effect on Castings- Location and Fixing.

UNIT–II

Melting: Melting Furnaces- Ferrous and Non-Ferrous Metals- Charging Operation in Cupola- Dissolved Gases in Molten Metal, Degassing Methods- Analysis and Composition of the Metal Ladle- Fluxes, Effect of Inoculation.

UNIT–III

Pouring and Feeding: Solidification of Metals- Equilibrium Diagram- Feeding Systems- Design of Runners and Risers- Cooling Rates of Different Sections, Casting Defects and Remedies- Stresses in Casting and Relieving Operations.

UNITIV

Foundry Mechanisation: Moulding- Core Making Sand Conditioning- Removal of Moulds- Pouring Methods- Shake out- Core Cleaning, Fettling, and Handling

Testing: Sand Testing, Moulding Testing- Testing of Casting- Instrument Sand Equipments used for Testing and Inspection.

UNIT–V

Advanced Casting Processes: Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO_2 moulding – Plaster Mould castings – Slush casting - Evaporative pattern casting.

TEXT BOOKS

1) Campbell, "Casting and Forming Process", McGraw-Hill, 1997.
2) Heine, R.W., Rosenthal, P.C., & Loper, C.R., "Principles of Metal Casting", Tata McGraw-Hill, 1997.

REFERENCE BOOKS

1) Jain, P.L., "Principles of Foundry Technology", Tata McGraw-Hill, 1997.
2) Merck, "Fundamentals in the Design and Production of Casting", McGraw Hill.
3) Banga, T.R., Agarwal, R.E., and Tahil Manghrani, "Foundry Engineering", Khanna Publishers, New Delhi, 1992.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the basic features and terminologies in casting process, gating, reserving system and their design aspects, the basics in solidification or the casting formation.
2) To obtain knowledge in the advanced casting process
3) Study the types of defects occurred in casting and provide remedial solutions.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						
CO2	✓		✓						
CO3	✓	✓	✓	✓					

04PC504	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To familiarize the basic concepts of CAD / CAM / CIM.
- To introduce the various aspects of automated manufacturing.
- To introduce the fundamentals of materials handling and storage system and robotics.
- To introduce the concepts of automated assembly and control system.

UNIT–I : Introduction

Product design & CAD, CAM, CAD/CAM and CIM – CIM Hardware and Software – Three Step Process for Implementation of CIM – Production Concepts and Mathematical Models Covering Production Rate, Manufacturing Lead Time, Capacity Utilization, Availability & WIP – Automation – Reason for Automation and Automation Strategies.

UNIT–II : Automated Production Systems and Material Handling & Storage System

Basic Elements of an Automated System – Advanced Automated Functions – Levels of Automation - Fundamentals of Automated Production Lines – Work Part Transfer Mechanisms – Storage Buffers – Control of the Production Line – Application to Machining System Material Handling and storage system: Overview of Materials Handling Equipment – Factors Influencing Material Handling System – 10 Principles of Material Handling – Material Transport System: Industrial Trucks, Mono-Rails and other Rail-Guided Vehicles – Conveyors, Cranes & Hoists – Automated Guided Vehicle System: Types, Guidance Technology, Vehicle Management, Dispatch Rules and Safety – Storage Systems – Performance, Storage Location Strategies, Conventional Methods – Automated Storage and Retrieval Systems – Carousel Storage Systems.

UNIT–III : Robotics

Industrial Robots: Definition – Robot Anatomy – Types and Classifications – Work Envelope – Co-ordinate Systems – Notations – End Effectors: Grippers and Tools – Robot Sensors and Machine Vision System – Robot Work cell – Robot programming – Robot Applications – Recent developments.

UNIT–IV : Group Technology & Flexible Manufacturing System

Group Technology: Definition – Part Families – Visual – Parts Classification and Coding – Case Studies In Coding – Production Flow Analysis – Composite Part Concept – Benefits of GT – Application of GT – Cellular Manufacturing Flexible Manufacturing System (FMS): Definition – Types of FMS – FMS Components – Workstations – FMS Layout – FMS Application and Benefits.

UNIT–V : Automated Assembly, Computer Process Control and Shop Floor Control

Automated Assembly: Fundamentals – System Configuration, Part Delivery at Work Station – Design For Automated Assembly Computer Process Control: Continuous, Discrete Process, Control Requirement, Capabilities, Level of Process Control – Computer Process Control – Computer Process Interface, Computer Process Monitoring, Direct Digital Control, Supervisory Control – Distributed Control System and Personal Computer.

Short Floor Control: Three Phases – Factory Data Collection – Manual Method – Automated and Semi-Automated Data Collection (ADC) – Bar Code Technologies and Other ADC Technologies.

TEXT BOOKS

1) Mikell P. Groover, "Automation, Production Systems and Computer-integrated Manufacturing", 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2007.
2) Mikell P. Groover, Weiss, M., Nagel, R.N., and Odrey, N.G., "Industrial Robotics: Technology, Programming and Applications", McGraw-Hill Book Company, New Delhi.

REFERENCE BOOKS

1) Radhakrishnan, P., Subramanyan, S., and Raju,.V,, "CAD/CAM/CIM", New Age International Publishers, 2000.
2) Yorem Koren, "Computer Integrated Manufacturing", McGraw-Hill, 2005.
3) Rao, P.N, "CAD/CAM - Principles and Applications", Tata McGraw-Hill Publications, 2007.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Provide engineering knowledge on the importance of CAD / CAM / CIM.
2) Understand the various aspects of automated manufacturing.
3) Provide knowledge on the concepts of automated assembly and control system.
4) Understand the usage of modern materials handling and storage system and industrial robots.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						
CO2		✓							
CO3									
CO4				✓		✓			✓

04CP507	MACHINE SHOP AND FOUNDRY PRACTICE	L	T	P
		0	0	3

COURSE OBJECTIVES

- To provide hands-on experience on the use of metal307 working machines and on preparing various types of moulds.

LIST OF EXPERIMENTS

FOUNDRY SHOP

1) Face Plate (Solid Pattern)
2) Hexagonal Nut (Self Core solid Pattern)
3) Lathe Saddle (Loose Piece Pattern)
4) Oil Cup (Self Core solid Pattern)
5) Ball Handle (Split Pattern)
6) Pipe Flange (Split Pattern)
7) Pulley (Split Pattern)
8) Gear wheel (Solid Pattern).

MACHINE SHOP

1) Plain Turing
2) Step Turing
3) Taper Turing
4) Thread Cutting (Internal & External)
5) Knurling.

WOOD TURNING PRACTICE

1) Coat Stand
2) File Handle
3) Form Turning.

COURSE OUTCOMES

Upon the completion of this course, students would be able to

1) Handle metal working machines like lathe and shaper
2) Prepare green sand moulds for any given component.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓	✓					
CO2	✓		✓						
CO3									

04CP508	**METROLOGY AND MEASUREMENTS LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To educate the students on the handling and use of precision measuring instruments used during the manufacturing processes.

LIST OF EXPERIMENTS

1) Checking the straightness of straight edge
2) Calibration of a dial gauge
3) Measurement of internal diameter (4 balls)
4) Calibration of micrometer
5) Measurement of internal taper
6) Measurement of external taper (Sine Bar and Roller)
7) Calibration of plain plug gauge
8) Measurement of external radius and internal radius
9) Inspection of screw thread
10) Lathe tool dynamometer
11) Power measurement in a lathe
12) Gear inspection
13) Checking the flatness of surface plate
14) Process capability
15) Estimation of cutting forces by merchant's theory
16) Study of spindle speed structure

17) Alignment test on lathe
18) Grinding tool dynamometer
19) Electric discharge machining.

COURSE OUTCOMES

Upon the completion of this course, students would be able to

1) Understand the usage of many precision instruments and their respective handling methods.
2) Learn to calibrate the precision instruments.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓	✓				
CO2	✓			✓	✓				

SIXTH SEMESTER

04PC601	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P
		4	0	0

COURSE OBJECTIVES

- To provide an understanding of the modern approaches to manage the operations.
- To present a broad conceptual framework for the management of the operations function in an organization.

UNIT–I

Production and operation management – Evolution and objectives - Concept of Production system - Types of Production systems – Continuous, Intermittent - Elements of Production planning and control, concept of Productivity - Production versus Services. Aggregate planning: Costs, Strategies – Application of chase and level strategies and Transportation model - Simple problems.

UNIT–II

Capacity planning: Defining and measuring capacity –determinants of effective capacity –Developing capacity alternatives.

Forecasting - components of demand - Quantitative methods - Single moving average method - Single exponential smoothing method - Simple linear regression model –- Measures of accuracy - Illustrative examples - Qualitative Methods.

UNIT–III

Inventory planning and control: Need, inventory costs, Determination of EOQ, EPQ/ELS (without shortages) - Effect of quantity discounts. Determination of ROL, Safety Stocks - Methods of calculating safety stock using Normal - single period inventory model, Inventory control systems - P, Q, and S-s System.

UNIT–IV

Materials Requirements Planning (MRP) - Master Production Schedule (MPS), Bill of Materials (BOM), MRP concept, Lot sizing: Lot-for-lot technique, EOQ approach, Periodic order quantity approach – Illustrative Examples.

UNIT–V

Operations scheduling and sequencing: Notations and definitions - Job shop scheduling: sequencing of n jobs through one machine - Priority decision rules – Measures of Performance - n jobs through 2 machines - Jackson's rule. Flow shop scheduling: sequencing of n jobs through 2, 3 machines, Johnson's rule. n jobs through m machines - CDS algorithm.

TEXT BOOKS

1) Pannerselvam, R., "Production and Operations Management", PHI Learning Pvt. Ltd., 2008.
2) Charry, S.N., "Theory and Problems in Production and Operations Management", Tata McGraw Hill, 2005.

REFERENCE BOOKS

1) Joseph G. Monks, "Theory and Problems of Operations Management", Tata McGraw-Hill Publishing Company Limited, 2nd Edition, 2004.
2) Anil Kumar, S., and Suresh, N., "Production and Operations Management", New Age International (P) Limited Publishers, 2nd Edition, 2008.
3) Everett E. Adam, and Jr. Ronald J. Ebert, "Production and Operations Management", Prentice-Hall of India Private Limited, 5th Edition, 1994.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Develop an understanding of various types of production systems.
2) Differentiate Production and services.
3) Gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing/service firms.
4) Develop the ability to identify operational methodologies to assess and improve an organizations performance.
5) Gain ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making in the areas such as aggregate planning, Inventory control, forecasting MRP and scheduling.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2	✓								
CO3			✓						
CO4			✓						
CO5					✓				

04PC602	METAL FORMING PROCESSES	L	T	P
		4	0	0

COURSE OBJECTIVES

- To familiarize the students the types of stress, in two and three dimensional.
- To provide basic knowledge of secondary processes and condition for manufacturing defect free end-product.
- To illustrate the concepts of various advanced metal forming processes.

UNIT–I

State of stress in two dimensions – two and three dimensions - Principal stresses, Stress deviator, Vonmises criteria, yield criteria. Comparison of yield criteria, Forming load calculation - Fundamentals of Metal working: Flow curve, Relationship between true stress and true strain, Temperature in metal forming, hot cold and warm working – residual stresses.

UNIT–II

Forging: Types of Process & hammers defects & remedies. Forging classification, open die forging, Closed die forging - calculations of forging loads, Defects - causes - remedies.

Rolling: Rolling of blooms billet, Slab & Sheet, types of rolling mills – hot and cold rolling - forces & geometrical relationship in rolling, Analysis of rolling load, torque & power, defects - causes and remedies.

Unit–III

Drawing of rods, wires & tubes: Simple analysis of wire tube drawing . residual stress is rod, wire & tubes.

Extrusion – classification – hot and cold extrusion – deformation, lubrication - simple analysis of extrusion process - hydrostatic extrusion - tube extrusion, production of seamless pipes and tubes - extrusion defects causes and remedies .

Unit–IV

Sheet Metal Forming: Forming methods – shearing and blanking – bending – types of bending – spring back – Deep drawing – Mechanism of Deep drawing – Limiting draw ratio – Concept of Forming Limit Diagram. Description only: Stretch forming – Rubber pad forming – Tube hydro forming – defects in sheet metal forming.

Unit–V

High Speed Forming: Basic principle, process variables, Characteristics and application of the following processes: Electro hydraulic forming, electromagnetic forming, explosive forming, fuel combustion process, water hammer forming. Comparison between conventional forming and high speed forming.

TEXT BOOKS

1) Rowe, G.W., “An Introduction to the Principles of Metal Working”, Edward Arnold Publication.
2) George E. Dieter “Mechanical Metallurgy”, McGraw-Hill International Edition, Newyork, 1998.

REFERENCE BOOKS

1) Robert H. Wagoner and Jean Loup Chenot., "Fundamentals of Metal Forming", John Wiley & Sons Inc., New York, 1992.
2) Calladine, C.R., "Plasticity for Engineers", John Wiley & Sons, 1991.
3) Metals Handbook, "Material Information Society", ASM, Vol.4, 1979.
4) Rao, P.N., "Manufacturing Technology – Foundry, Forming and Welding", Tata McGraw Hill, 1998.
5) Davies, R., and Austin, E.R., "Developments in High Speed Metal forming", The Machinery Publishing Co. Ltd., London, 1970.
6) Haslehurst, "Manufacturing Technology", ELBS, 1973.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the stresses and component of stresses.
2) Expertise different forming process to manufacture near net- shape product.
3) Impart basic knowledge on various high speed forming processes.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2			✓	✓					
CO3						✓			

04CP607	**METALLURGY & MATERIALS PROCESSING LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To educate the importance of metallurgical aspects of ferrous and non-ferrous metals and learn the influence of various process parameters during material processing methods.

LIST OF EXPERIMENTS

1) Effect of section size on hardness
2) Effect of quenching media on hardness
3) Jominy hardenability test
4) Microscopic examination of a metallic specimen and determination of grain size
5) Estimation of creep rate of a given specimen
6) Characteristics of moulding sand
7) Formability of sheet metals by water hammer technique
8) Rolling of metal strips
9) Disc compression test
10) Study on basic weld joints
11) Comparative evaluation of welding performance of arc welding power sources
12) Effect of heat input on bead geometry
13) Effect of electrode polarity on tig welding performance
14) Temperature measurement in arc welding process.

COURSE OUTCOMES

Upon the completion of this course, students would

1) Have practical knowledge about the metallurgical aspects of ferrous and non-ferrous metals.
2) Understand the parameters that influencing various material processing methods.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓	✓					
CO2	✓	✓		✓					✓

04CP608	**FINITE ELEMENT ANALYSIS LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To train the students to make use of finite element analysis software for various applications in the field of manufacturing engineering.

LIST OF EXPERIMENTS

1) Study on Basic FEA, Nodes, Elements, Boundary Conditions.
2) One Dimensional FEA Problem.
   a. Truss structure analysis.
   b. Cantilever analysis.
3) Two Dimensional FEA Problems.
   a. Plane stress analysis.
   b. Temperature distribution analysis.
   c. Axisymmetric analysis.
   d. Contact element analysis.
4) Non-linear FEA Problem
   a. Nonlinear Beam analysis.
   b. Geometrical nonlinear analysis.
   c. Material nonlinear analysis.
5) Three Dimensional FEA Problems.
   a. 3D Shell Analysis.
   b. 3D Analysis.
6) FEA Application in metal forming, metal cutting, fluid flow process etc.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Perform finite element modeling analysis of solid mechanics.
2) Perform finite element modeling analysis of heat transfer problems, shell and contact problems in 2D and 3D.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2		✓	✓	✓	✓				✓

SEVENTH SEMESTER

00HS701	ENGINEERING ETHICS	L	T	P
		4	0	0

COURSE OBJECTIVES

- To understand the moral and ethical dimensions in engineering.
- To take balanced decisions.

UNIT–I

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT–II

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT–III

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT–IV

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT–V

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TEXT BOOKS

1) Govindarajan, M., Natarajan, S. and Senthilkuma, V.S., "Professional Ethics and Human Values", PHI Learning, New Delhi, 2013.
2) Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.

REFERENCE BOOKS

1) Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.
2) Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
3) John R. Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
4) Edmund G. Seebauer and Robert L. Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
5) David Ermann and Michele S. Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Understand the relationship between the engineer and the society.
2) Learn the importance of codes in engineering practice.
3) Acquire knowledge on the legal, moral and ethical aspects in engineering.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓					✓			
CO2			✓			✓		✓	✓
CO3			✓			✓			

04PC702	**OPERATIONS RESEARCH**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce students the use of quantitative methods and techniques for effective decisions–making.
- To provide an understanding of the systematic approach to solve decision making problems.
- To enhance the decision-making skills through the application of appropriate models.

Unit–I

Linear programming - graphical method - Simplex method - Big M method- Applications – Problems.

Unit–II

Transportation problems - optimal solutions. Assignment problems - Hungarian algorithm - Traveling salesman problem – applications – Problems.

Unit–III

Waiting line Problems - cost of waiting and cost of providing service - single channel - single stage type of problems - Monte Carlo simulation for queue problems.

Network models - Minimal spanning tree problem, shortest route problem and Maximum flow problem.

Unit–IV

PERT and CPM - basic steps - rules for constructing the network - Fulkerson's rule - time estimates - PERT calculations - probability of meeting the time schedule - time - cost trade off (crashing) - difference between PERT and CPM – applications.

Unit–V

Decision Theory - Decision making under risk condition - expected value criteria - Decision trees - Decision making under uncertain conditions - Minimax, maximin, maximax, Hurwitz regret criteria.

TEXT BOOKS

1) Gupta and Hira, “Operations Research”, S. Chand & Co., 1998.
2) Vohra, N.D., “Quantitative Techniques in Management”, Tata McGraw-Hill, 1990.

REFERENCE BOOKS

1) Sharma, S.D., "Operations Research", Kedarnath Ramnath and Co., Meerut, 1998.
2) Barry Render, Ralph M. Stair Jr., "Quantitative analysis for Management", Pearson New Delhi, 2010.
3) Ravindran, A., Phillips, D.T., and Solberg, J.J., "Operations Research, Principles and Practice", John Wiley and Sons, Singapore, 1987.
4) Taha, "Operations Research", Tata McGraw-Hill, 1998.
5) Bronson, R., "Theory and Problems of Operations Research", Schaum's outline series, 1997.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Impart the basic characteristics of different types of decision-making environments.
2) Enhances the student's ability to build and solve various operations research models.
3) Expertise to select appropriate decision making models for the real life problems.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2					✓				
CO3			✓						

04CP706	**SPECIAL MACHINES LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To provide hands-on experience to the students on the handling various metal machining machine tools used on the shop floor.

LIST OF EXPERIMENTS

1) Plain milling
2) Spur gear milling
3) Helical gear milling
4) Key way machining on a slotter
5) Convex profile machining on a slotter
6) T-slot milling
7) Keyway machining using a shaper
8) External dovetail machining on a shaper
9) Internal dovetail machining on a shaper
10) Straight tooth clutch milling (3/4 dogs)
11) Flute milling
12) Pantograph milling
13) Study of Single-spindle automatic lathe

14) Study of capstan lathe and turret lathe
15) Study of gear hobbing machine
16) Study of cylindrical grinding machine
17) Study of surface grinding machine.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Handle various types of metal machining machines available on the shop floor.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓					✓

04PV803	**PROJECT WORK AND VIVA-VOCE**	**L**	**T**	**P**
		0	**0**	**15**

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

- Take up any challenging practical problems and find solution.
- Learn to adopt systematic and step-by-step problem solving methodology.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓			✓			✓	✓
CO2		✓		✓			✓		

04PEXXX	**MECHANICS OF MATERIALS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- To study the effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses.

Unit–I

Define of stress – types of stresses: Direct stress (Tensile and compressive), Bending stress, Shear stress, temperature stress, composite stress – Strains: Linear strain, lateral strain, volumetric strain, temperature strains- Hook's Law- modulus of elasticity- Axial rigidity-Flexural rigidity – Torsional rigidity- poison's ration,

stress versus strain diagrams for concrete, timber, mild steel sections, HYSD (High Yield Strength Deformed) bars. Elastic constants relationship- simple problem-Banding stress and strain variations for rectangular sections-Shear stress variations for rectangular sections.

Unit–II

Stain Energy-stain Energy stored in an elastic body due to axial force- Strain Energy stored in an elastic body due to bending – Strain Energy stored in an elastic body due to shear – Strain Energy stored in an elastic body due to torsion- strain Energy stored in an elastic body due to gradually applied loads - Strain Energy stored in an elastic body due to suddenly applied loads or impact load-Stress at a point – stress tensor- Equations of Equilibrium-Uni-axial state of stress-Stresses on a plane-Transformation of plane stress- Principle stresses and maximum shear stress-Mohr's Circle for plane stress.

Unit–III

Loads: Gravity and lateral loads, concentrated loads, uniformly distributed loads, Beams: Cantilever beams, simply supported beams, single and double over hanging beams support Conditions: removed hinged support, Roller support and load and reactions –Bending moments and shear force diagrams-points of contra flexure-Variation of bending stress for rectangular and circular sections-section modulus-neutral axis- Moment resistance. Simple bending Theory (Euler Bernoulli Theory) – Deflection of determinative beams-Strain Energy methods-Double Integration Methods-Macaulay's Methods.

Unit–IV

Torsion-Theory of pure torsion in circular shafts-Variation of shear stress distribution across the solid (Circular), Hollow (Circular), and thin walled sections-saint venant's torsion- warping torsion- Torque transmitted in circular and hollows shaft.

Spring-stiffness-linear stiffness and rotary stiffness-types: Helical (Open coiled, close coiled) and leaf spring uses – spring in series and – spring in parallel – load versus deformation ship-spring deflections. Stiffness and shear stress. – Automobile springs.

Unit–V

Simple machines-inclined plane- Law machine-Effort and load lifted- Mechanical advantages and Efficiency- Ideal machine-Levers – Wedges-screw jack-Gears- Belts-pulleys-wheel and Axle-Differential pulleys-Worm and wheel-Handle winch.

TEXT BOOKS

1) Bansal. R.K., "A text Book on Engineering Mechanics", Lakshmi Publications, New Delhi, 2005.
2) Sadhu Singh. P., "Strength of Materials", Khanna Publishers. 1990.

REFERENCE BOOKS

1) Timoshenko, S., and Young, D.H., "Strength of Materials", East west Press New Delhi, 1968.
2) Rajput, R.K., "Strength of Materials", S. Chand Company, New Delhi, 1999.
3) Nash, W.A., "Strength of Materials", Schaums series - McGraw-Hill Publishing company, 1989.
4) Ramamrutham, S., "Strength of Materials", Dhanpat Rai and sons, New Delhi, 1986.

COURSE OUTCOMES

Upon completion of the course, the student to

1) Develop knowledge on identifying loads, stress, strain and their effects
2) Critically analyses components like beams and twisting bars
3) Understand theories on columns and springs
4) Employ all the knowledge gained in designing of machine components.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓						
CO2	✓	✓							
CO3	✓				✓				
CO4	✓		✓						

04PEXXX	**ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To explain the operating principle of DC motors, Transformers, AC induction and synchronous motors.
- To introduce the basic theory of various semiconductor devices and their applications.
- To illustrate the usage of transistorized circuits in different applications including amplifiers and oscillators.

Unit–I : DC Motors

DC motors – principle of operation – back emf – lap and wave windings – commutator – speed and torque equations – method of speed control – speed-torque characteristics of series, shunt and compound motors – efficiency – swinburne's test – applications of DC motors – starters – necessity and use – types of starters and connections.

Unit–II : Transformers

Transformer – working principle – phasor diagram for no load and loaded conditions – equivalent circuit – OC and SC tests – efficiency and voltage regulation –auto transformer – three phase transformers – constructional features – connections – line voltage and current relations.

Unit–III : Induction and Synchronous Motors

Three phase induction motors – types – principle of operation – rotating magnetic field – synchronous speed and slip – equivalent circuit – torque-slip characteristics – starters – single phase induction motors – principle of operation – types – starting methods – applications. Alternators – principle of operation and constructional features – salient and non-salient pole machines – voltage regulation – emf method – synchronous motors – phasor diagram – power factor control – applications.

Unit–IV : Electronic Devices

P-N junction – characteristics and uses of semi conductor devices: diode, photo diode, zener diode, BJT, FET, UJT and SCR – half wave, full wave and bridge rectifier circuits – filters – zener voltage regulators.

Unit–V : Amplifiers and Oscillators

Transistorised amplifiers and oscillators: classification and characteristics – voltage, current and power gain – frequency response – audio amplifier – principle of negative feedback – emitter follower – power amplifier – class A, B, C – applications – oscillators – RC phase shift – Hartley and UJT oscillators.

TEXT BOOKS

1) Theraja, B.L., "A text book of Electrical Technology", S. Chand & Co., New Delhi, 2005.
2) Premkumar, N., "Basic Electrical and Electronics Engineering", 4th Edition, Anuradha Publications, Kumbakonam, 2008.

REFERENCE BOOKS

1) Rajput, R.K., "A text book of Electrical Machines", Lakshmi Publications, 2006.
2) Metha, V.K., "Principles of Electronics", S. Chand&Co., New Delhi, 2014.

COURSE OUTCOMES

1) Understand the DC and AC motor operation.
2) Explore the operation and application transformers.
3) Establish the working of semiconductor devices.
4) Suggest the applicability of transistors for amplifiers and oscillators.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2		✓	✓						
CO3			✓	✓					
CO4				✓					

04PEXXX	**MACHINE TOOL CONTROL**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To understand the working principle of hydraulic and pneumatic components and their selection.
- To explore the use of different sensors, control valves, controllers and actuators for electro-pneumatic & hydraulic circuits.
- To provide a knowledge of trouble shooting and design of hydraulic and pneumatic circuits for different applications.

UNIT–I : Fluid Power Principles and Hydraulic Pumps

Introduction to Fluid power: Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Application - Advantages of hydraulic control.

Hydraulic pumps: Pump Classification- gear, vane, piston, Linear, Rotary- Fixed and Variable displacement pumps – Motors-Construction, Working principle.

Unit–II : Hydraulic Valves and Accessories

Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, unloading - sequence valves, counter balance valves - Construction and Operation.

Accessories: Accumulators, Reservoirs, Filters- Fluid Power - ANSI Symbols.

Unit–III : Hydraulic Circuits

Speed control circuits - Accumulator circuits - Regenerative - Pressure Intensifier, Sequence, Reciprocation, Synchronization circuits – Mechanical Hydraulic servo systems.

Unit–IV : Pneumatic Systems

Properties of air– Pneumatic control - Principles - Pneumatic valves - compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators- cascading system of circuit design.

Introduction to Fluidics: Fluidic control - Logic Elements - Amplifiers - Logic circuits.

Unit–V : Trouble Shooting and Applications

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling.

TEXT BOOKS

1) Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.
2) Metha, N.K., “Machine Tool Design and Numerical Control”, McGraw-Hill, New Delhi,

REFERENCE BOOKS

1) Shanmugasundaram, K., “Hydraulic and Pneumatic controls”, Chand & Co, 2006.
2) Ernst, W., “Oil Hydraulic Power and its Industrial Applications”, McGraw-Hill, 1978.
3) Majumdar, S.R., “Oil Hydraulics Systems - Principles and Maintenance”, Tata McGraw-Hill, 2001.
4) Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata McGraw-Hill, 2007.
5) Stringers, J.D., “Hydraulic System Analysis”, MacMillan Press Publications, 1992.
6) Dudelyt A. Pease and John J. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
7) Srinivasan, R., “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.
8) John Pipinger and Hicks T.G., “Industrial Hydraulics”, McGraw-Hill, 1997.

COURSE OUTCOMES

Upon completing this course, students should be able to

1) Understand the concept and working of hydraulic and pneumatics components.
2) Gain ability to design hydraulic and pneumatics circuits.
3) Understand the benefits and applications of hydraulics and pneumatics systems.
4) Trouble Shoot and provide remedies of hydraulics and pneumatics systems.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓					
CO2	✓		✓						
CO3	✓		✓						
CO4		✓	✓						

04PEXXX	**TOOL ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce different production tools, including press tools, their design.
- To provide an understanding of design and use of jigs and fixtures.

Unit–I

Design principles of cutting tools – problems in cutting tool design – factors in tool design -. Single point cutting tool – chip breakers – determination of tool shank dimensions. Milling cutters – determination of number of teeth, teeth size and other features. Design features – drills – reamers - broaching tools.

Unit–II

Press tool design: Press classification – selection and features press. Dies – types – clearances. Progressive die design for typical components for blanking and piercing – compound die –combination die. Strip layout design – influencing factors.

Unit–III

Bending: Types of bending – determination of bending force – bend allowance – Springback. Drawing dies: Design of dies – blank development – Cup drawing - illustrative examples.

Ironing – calculation of number of draws. Design of forging dies – blank size. Materials for die block.

Unit–IV

Elements of Jigs and Fixure – Locating and clamping principles. Locating method and devices – Clamping devices. Types of Jigs: Plate, Template, Latch, Channel Leaf, Box and Indexing.

Unit–V

Modular work holding systems – POKA YOKE - quick change toolings - single minute exchange of dies – Computer aided fixture design – phases.

Plastic tooling – Plastic tool materials – construction methods – applications.

TEXT BOOKS

1) Sharma, P.C., “A Text Book of Production Engineering”, S.Chand Publisher, 2001.
2) Donaldson, G.H., Lecain, and Goold, V.V., “Tool Design”, Tata McGraw-Hill, 2000.

REFERENCE BOOKS

1) Rodin, P., "Cutting Tool Design", MIR Publisher, Moscow, 1968.
2) Wilson, F.W., "Die design Hand Book", McGraw Hill.
3) Wilson, F.W., "Fundamentals of Tool Design", ASTME, Prentice Hall, 1974.

COURSE OUTCOMES

Upon completing this course, students should be able to

1) Develop an understanding of the cutting tool nomenclatures.
2) Develop and design of progressive and compound dies for simple sheet metal operations.
3) Calculate bending force, number of draw for the required cup shape, blank size for forged components.
4) Understand the modern techniques of tool engineering and the various phases in computer aided fixture deign.
5) Acquire knowledge about the plastic tool materials and development methods.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2		✓				✓			
CO3			✓						
CO4	✓			✓					
CO5	✓	✓							✓

04PEXXX	**DESIGN OF MACHINE ELEMENTS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine components.

Unit–I

Introduction: Types of Design factors. Factor of safety, Theories of failure - Curved beam, crane hook and C frames.

Design for fatigue strength: S-N diagram - Endurance limit modifying factors - Stress concentration - Fluctuation stress – Soderberg & Good Man equations.

Unit–II

Thin cylinders – Stresses in thin cylindrical shell due to internal pressure – circumferential and longitudinal stresses and deformation in thin cylinders Design of mechanical elements: Shafts – Design for static load – bending and torsion –

Equivalent twisting moment. Coupling - Types - Design and selection of coupling - Flange coupling, Bushed pin type, flexible coupling design and selection.

Unit–III

Theory of columns: Design of push rod, piston rod and I.C. Engine connecting rods sections.

Wire ropes - Stresses - selection Design procedure–leaf springs - construction equalized stresses in leaves - material and design. Open and closed coiled helical springs stress - Wahl's factor.

Unit–IV

Power screws - Thread forms Design consideration and materials - wear and shear - design procedure. Threaded fasteners – Bolted joints – simple and eccentrically loaded bolted joints.

Unit V

Design of Joints: Riveted Joints: Introduction - Types of riveted joints - failures of a riveted joint - strength and efficiency - Design of boiler joints.

Welded joints: Introduction - Strength of transverse and parallel fillet welded joints - Axially loaded unsymmetrical welded sections - Eccentrically loaded welded joints.

TEXT BOOKS

1) Khurmi, R.S., "Machine Design", S. Chand and Company Ltd., New Delhi, 14th edition, 2005.
2) Pandya, and Sha., "Machine Design", Charotar Publisher, house, Anand, India

REFERENCE BOOKS

1) Richard Budynnas, J.E. Shigley's, "Mechanical Engineering Design", McGraw Hill Book Company, 8th ed., 2008.
2) Prabhu, T.J., "Fundamentals of Machine Design", Scitect Publisher 4th edition, 2000.
3) Sundararajamoorthy, T.V., and N. Shanmugam, "Machine Design", Anuradha Agencies, 2000.

COURSE OUTCOMES

Upon completing this course, students should be able to

1) To understand the functions of various machine elements and assemblies.
2) To design various machine components according to the requirement as per the prescribed standards.
3) To apply the knowledge of materials and their properties.
4) To use standard design data book.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2	✓		✓	✓					
CO3		✓	✓						
CO4	✓								

04PEXXX	MACHINE TOOL DESIGN	L	T	P
		4	0	0

COURSE OBJECTIVES

- To introduce the various drive systems used in machine tools.
- To understand the basic design aspects of various of machine tool components and structures.

Unit–I & II

Various driving systems for machine tools - Stepper motors - Use of preferred numbers in machine tools - Stepped drives - Graphical representation of speed - structural and ray diagrams - Optimum ray diagram - Ruppert drive - Feed gear boxes - Norton ssdrive - Meander drive. Various stepless regulation systems - principles of self aligning - methods of increasing the range of regulation in modern machine tools.

Unit–III

Machine tool guides - types - Design of guide ways - wear adjustment - Anti friction ways - Hydrodynamic and hydro-static slide ways.

Unit–IV

Machine tool beds - types - constructional and design features - Design of column of drilling and milling Machine - Stiffeners and ribs arrangement.

Unit–V

Design of power screws - compensation for backlash - Re circulating ball screw - Spindles - Materials - Construction, spindle supports - Preloading of Bearing Design of spindles - Air bearing and Hydrostatic bearings.

TEXT BOOKS

1) Basu, S.K., and Pal, D.K., “Design of Machine Tools”, Oxford and IBH, New Delhi, 1997.
2) Metha, N.K., “Machine tool Design and Numerical Control”, Tata McGraw-Hill, New Delhi, 1999.

REFERENCE BOOKS

1) Sen and Bhattacharya, “Principles of Machine Tools”, Volume- II, New Central Book Agency, Calcutta, 1990.
2) Acherkan, “Machine Tool Design”, Volume-I to IV, MIR Publishers, Moscow, 1978.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Develop an understanding of the various drive systems of machine tools.
2) Develop an understanding of the constructional and design features of machine beds, columns and guideways.
3) Develop and design power screws.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓			✓					
CO2		✓	✓						
CO3	✓	✓							

04PEXXX	**NON-TRADITIONAL MANUFACTURING PROCESSES**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the fundamentals of Non-Traditional Manufacturing Processes and their methods, applications advantages and disadvantages.
- To introduce the concept of nano technology and rapid prototyping.

Unit–I

Overview of non-traditional manufacturing – classification of processes under source of energy, transfer media and mechanism.

Electric Discharge Machining (EDM): Principles – equipment – power supply, dielectric system, electrodes – process parameters – applications.

Wire Electric Discharge Machining (WEDM): Principles – equipment – power supply, dielectric system, electrodes – process parameters – applications.

Unit–II

Abrasive Jet Machining (AJM): Principles – equipment – abrasives – nozzles– process parameters – applications.

Abrasive Flow Machining (AFM): Principles – equipment – tooling – media – process parameters – applications.

Water Jet Machining (WJM): Principles – equipment – nozzles – process parameters – applications.

Abrasive Water Jet Machining (AWJM): Principles – equipment – nozzles – Abrasive feed system – process parameters – applications.

Unit–III

Ultrasonic machining (USM): Principles – equipment – transducers – tool horns – abrasives, abrasive slurry – process parameters – applications.

Electro chemical machining (ECM): Principles – equipment – electrolytes – tools – process parameters – applications.

Chemical machining (CHM): Principles – equipment – masks, etchants – process parameters – applications.

Unit–IV

Electron Beam Machining (EBM): Principles – equipment – EB gun – power supply – process parameters – applications.

Laser Beam Machining (LBM): Principles – equipment – power supply – process parameters – applications.

Plasma Arc Machining (PAM): Principles – equipment – plasma torches – process parameters – applications Hot machining – Neutral particle technique – High speed machining.

Unit–V

Basic Principle of Nano technology - Rapid prototyping: basic concepts, techniques: Stereolithography, Selective Laser Sintering, Selective Powder Binding, Fused Deposition Modeling, Laminated Object Manufacturing – applications.

TEXT BOOKS

1) Pandey, P.C., and Shan, S.H., "Modern Manufacturing Processes", Tata McGraw Hill Pub. Co. Ltd., New Delhi
2) Amitabha Ghosh, "Rapid prototyping – A Brief Introduction", East-West Press Ltd.

REFERENCE BOOKS

1) Gary F. Benedict, "Non-Traditional Manufacturing Processes", Marcel Dekker, Inc., New York.
2) Amitabha Ghosh and Ashok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd.
3) Adithan, M.S., "Modern Machining Methods", Chand & Co. Ltd., New Delhi, 1990.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Distinguish between Traditional and Non-Traditional Manufacturing Processes.
2) Provide better knowledge on the concepts Non-Traditional Manufacturing Processes.
3) Understand the basic principles of nano technology and rapid proto typing.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2					✓				✓
CO3	✓			✓	✓			✓	

04PEXXX	ADVANCED MANUFACTURING PROCESSES	L	T	P
		4	0	0

COURSE OBJECTIVES

- To acquaint the students with recent developments in modern casting and welding processes.
- To introduce students to the scientific principles underlying material behaviour during manufacturing processes.
- To make students aware of the necessity to manage manufacturing processes and systems for the best use of material.

Unit–I

Advanced casting processes - plaster mold and ceramic mold casting – vacuum casting – Evaporative pattern casting, ceramic shell investment casting, slush casting, squeeze casting and semisolid metal forming-Rapid solidification for Amorphous alloys.

Unit–II

Advanced welding processes: Basic principle, Process variables, Chief characteristics and applications of the following processes: Laser beam welding, Electron beam welding, Plasma arc welding, Friction stir welding, Explosive welding, Ultrasonic welding and diffusion welding.

Unit–III

Powder metallurgy processes: Methods of Powder production – Blending of metal powders- Compaction of metal powders- Sintering – hot pressing – Isostatic pressing – hot and cold (HIP and CIP), selective laser Sintering – Other shaping processes – Metal Injection moulding, pressureless compaction, ceramic moulds – spray deposition - Finishing of sintered parts.

Unit–IV

Manufacturing processes for plastics: Extrusion, Injection, Blow and rotational moulding of plastics-Thermoforming-Compression moulding – Transfer moulding - Casting– Foam moulding - Processing of reinforced plastics and composite – Moulding – compression, vacuum bag – contact – resin transfer – transfer / injection. Filament winding.

Unit–V

Rapid prototyping and rapid tooling: Introduction – Stereo lithography – Fused deposition moulding – selective laser machining – Laminated object manufacturing – solid base curing – Direct manufacturing and rapid tooling.

TEXT BOOKS

1) Serope Kalpakjian, and Steven R. Schemid, “Manufacturing processes for Engineering Materials”, 4th edition, Pearson Education, 2003.
2) Serope Kalpakjian, and Steven R. Schemid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education, 2003.

REFERENCE BOOKS

1) Brahem T. Smith, "Advanced machining", I.F.S., U.K.1989.
2) Amstead, B.H., Ostwald Phylips and Bageman. R.L., "Manufacturing Processes" John Wileys Sons, 1987.
3) Muccic, E.A., "Plastic Processing Technology", Materials park, OHIO, ASM Int., 1994.
4) Jaeger, R.C., "Introduction to microelectronic Fabrication", Addision-Wesley, 1988.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) The student will be able to understand the latest processes in the field of Manufacturing Technology.
2) An understanding of Powder metallurgy processes, Welding processes, Processes for plastics will be applied in the industry.
3) Realize the need and place for rapid prototyping approach.
4) Ability to develop a project on design and product development, considering advanced production technologies.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1			✓	✓					
CO2			✓						✓
CO3			✓		✓				✓
CO4			✓	✓				✓	

04PEXXX	**SURFACE ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

This course will enable the student

- To familiarize the basic concepts of Surface Engineering and Tribology.
- To introduce the various aspects of wear, its mechanism and control.
- To introduce the fundamentals of various surface modification processes.
- To introduce the concepts of thick film and thin film coatings.

Unit–I

Mechanisms of wear and metal cleaning: Basic mechanisms of wear - abrasive, adhesive wear, contact fatigue – fretting corrosion – Testing of wear resistance – Practical diagnosis of wear – General cleaning process for ferrous and non ferrous alloys – Selection of cleaning processes – alkaline cleaning, emulsion cleaning abrasive bath cleaning – polishing, buffing and hot peering.

Unit–II

Thermal spraying processes and Electro deposited coatings: Thermal spraying-materials, characteristics of thermal spray process – Designing for thermally sprayed coatings – coating production – spray fused coatings – Principles of electroplating – technology and control – electroplating – Technology and control – electroplating systems – properties and applications of electro deposits - non - aqueous and electroless deposition.

Unit–III

Hot dip coating and diffusion coatings: Principles – surface preparation-batch coating and continuous coating – properties and applications principle of cementation – cladding, vacuum deposition – sprayed metal coating – structure of diffusion coatings – chemical vapor deposition – physical vapor deposition.

Unit–IV

Non-metallic coatings and conversion coatings: Plating coating – lacquers – rubbers and elastomers – Vitreous enamels – anodizing, Chromating, Phosphating.

Unit–V

Weld surfacing: Hard facing, overlaying – Laser cladding – Explosive cladding – Roll bonding - Testing and inspection of coatings: Thickness and porosity measurement – selection of coatings.

TEXT BOOKS

1) Stan Grainger, "Engineering Coatings – Design and Applications", Jaico, 1994.
2) Parthasarathy, N.V., "Electroplating Hand Book", Prentice Hall, 1992.

REFERENCE BOOKS

1) Gale, D.R., "Principles of Metal Surface Treatment & Protection", Pergamon, 1990.
2) Niku-Lavi, "Advances in Surface Treatments", Pergamon, 1990.
3) "Metals Handbook on Surface Engineering", 8th Edition, ASM, 1994.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Provide engineering knowledge on the importance of methods of Surface Engineering.
2) Understand the various aspects of thick film coatings and thin film coatings for manufacturing products.
3) Provide better knowledge on the concepts on surface characterization.
4) Understand the usage of implementation on testing of coatings and inspection of surface on surface engineering.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		✓							
CO2					✓				
CO3				✓					
CO4				✓					

04PEXXX	**NON DESTRUCTIVE TESTING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the various aspects of destructive testing and Non destructive testing.
- To introduce the fundamentals of advanced materials testing methods.

Unit–I : Liquid Penetrant and Magnetic Particle Inspection

Liquid penetrant system – Processing cycles –Inspection of surface defects-Generation of Magnetic fields-Magnetic particle inspection equipments – Demagnetization- Applications and limitations.

Unit–II : Radiography

Production of X-rays – Characteristics rays and white rays- Tube current and voltage – Source of γ ray - Half-life period- Penetrating power – Absorption of x and γ ray – Radiation contrast and film contrast- Exposure charts - penetrameters and sensitivity –Safety.

Unit–III : Eddy Current Inspection

Eddy current production – Impedance concepts –Inspection of magnetic materials-Inspection of Non magnetic materials –Influences of various parameters-Advantages and limitations.

Unit–IV : Ultrasonic Testing

Production of ultrasonic waves – Different types of waves-Normal beam inspection –Angle beam inspection-Thickness measurements –Applications.

Unit–V : Recent Techniques

Principle of acoustic emission- Instrumentation for Non destructive testing-Principles of holography-Applications of holographic techniques Non destructive inspection-Advantages and limitations- Other techniques.

TEXT BOOK

Barry Hull and Vernon John, "Non Destructive Testing", Mac Millan, 1988.

REFERENCE BOOKS

1) Metals Hand Book, "American Society of Metals", 9thEdition,Volume-11, 1980.
2) Birchand, D., "Non Destructive Testing", Oxford University Press, 1977.
3) Proceedings of the 10th International Acoustic Emission Symposium, Japanese Society for Non Destructive Inspection, Sendai, 1990.
4) Holler, P., "New Procedures in Non Destructive Testing", Springer Verlag, 1983.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) To provide better understanding of the principles of various Non destructive testing methods.
2) To impart knowledge on the advantages and disadvantages of the processes.
3) Able to select appropriate NDT method for testing of defects.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								✓
CO2		✓	✓	✓		✓	✓		
CO3	✓								✓

04EPXXX	**CAD / CAM LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To impart hands on experience to students in Geometric Modeling, Assembly and Engineering Drafting.
- To introduce the concepts of CNC programming and simulation on CNC turning, CNC Milling machines.

LIST OF EXPERIMENTS

Sketcher

Introduction- Basic sketch, Constraints – Geometry & Dimensional.

Solid Modeling

Extrude, Revolve, Sweep, Loft, Datum plane creation etc.,

Surface Modeling

Extrude & Revolve surfacing, Advance surfacing technique – Ruled & Loft surfacing, Mesh of curves, Free form surfaces, Surface operations – trim, merge, intersect, etc,.

Feature Manipulation

Copy, Edit, Pattern, Suppress, History operations etc.,

Assembly

Constraints, Patterns, Exploded views, Interference check, creating components from assembly, mass property calculations, and assembly cut sections.

Drafting

Standard view, Sectional views and Detailing.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Gain practical experience in handling 2D drafting and 3D modeling using modeling software systems.
2) Understand and apply the concepts G and M codes and manual part programming of turning and milling processes.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	✓	✓	✓						
CO2	✓	✓			✓				✓

04EPXXX	MECHATRONICS AND CNC LABORATORY	L	T	P
		0	0	3

COURSE OBJECTIVES

- To provide some hand on experience in the use of hydraulic & pneumatic components.
- To formulate simple circuits which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS

1) Study of various pneumatic and electro-pneumatic components.
2) Study of pneumatic and electro-pneumatic symbols, circuits.
3) Study of PLC, Ladder Diagram and its applications.
4) Study of characteristics of sensors.
5) Study of image processing technique.
6) Modelling and analysis of pneumatic and electrical circuits using FluidSim/P Software.
7) Application on Pneumatics
    a. Actuating a cylinder using Direction Control Valves
    b. Actuating a cylinder using Non-Return Valves.
    c. Actuating a cylinder using Flow Control Valves.
    d. Actuating a cylinder using Pressure Control Valves.
    e. Actuating a cylinder using Shut-off Valves.
8) Application on Electro Pneumatics
    a. Actuating a cylinder using Logic Functions
    b. Actuating a cylinder using 3/2, 5/2, Solenoid Valves
    c. Actuating a cylinder using Electrical Limit Switches
    d. Actuating a cylinder using Sensors, Pressure Control Valves
9) Application on Programming Logic Control (PLC)
    a. Actuating a cylinder using Logic Functions
    b. Actuating a cylinder using 3/2, 5/2, Solenoid Valves
    c. Actuating a cylinder using Electrical Limit Switches
    d. Actuating a cylinder using Sensors, Counters, Pressure Control Valves.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Understand the functional aspects of different pneumatic and hydraulic components and its use in circuits.
2) Construct and demonstrate pneumatic, electro pneumatic and PLC circuits for various applications.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓						
CO2	✓		✓	✓					✓
CO3									

04EPXXX	**HYDRAULICS LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To understand the properties of fluids and fluid statics, methods for determination of co-efficient of discharge.
- To study of the characteristic features of pumps and turbines.
- To understand the significance and role of such utilities in their further course of study.

LIST OF EXPERIMENTS

1) Determination of Co-efficient of discharge of Mouth Piece
2) Determination of Co-efficient of discharge of Venturimeter
3) Determination of Co-efficient of Head loss due to Sudden Change in Section
4) Determination of Co-efficient of Head loss due to Friction in Pipe
5) Determination of Co-efficient of discharge of Rectangular Notch
6) Study of Performance characteristics of Elmo Pump (Centrifugal Pump)
7) Study of Performance characteristics of Sump Pump (Centrifugal Pump)
8) Study of Performance characteristics of Submersible Pump (Centrifugal Pump)
9) Study of Performance characteristics of Gould's Pump (Reciprocating Pump)
10) Study of Performance characteristics of Pelton Turbine (Constant Speed method)
11) Study of Performance characteristics of Francis Turbine (Constant Head method)
12) Determination of Metacentric Height of a floating vessel (Demo Only).

COURSE OUTCOMES

After completion of this course, student will be able to:

1) Determine the properties of fluids, pressure and their measurements.
2) Measure flow in pipes and determine frictional losses.

3) Compute forces on immersed plane and curved plates applying continuity equation and energy equation in solving problems on flow through conduits.
4) Develop Characteristics of pumps and turbines.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2		✓	✓						
CO3		✓	✓		✓				
CO4			✓						

04EPXXX	**COMPUTING AND SIMULATION LABORATORY**	**L**	**T**	**P**
		0	**0**	**3**

COURSE OBJECTIVES

- To provide hands on experience in some basic mathematical and statistical operations using various softwares.

LIST OF EXPERIMENTS

1) Simulation basics, dealing with matrices, Graphing- Functions of one variable and two variables.
2) Response of under damped single degree of freedom systems to initial excitations.
3) Response of single degree freedom to harmonic and pulse excitations.
4) 2D, 3D plots, Control Charts, Frequency response plots
5) Solving of Linear Algebraic Equations, Quadratic Function and Discrete Function
6) Manufacturing Design Calculations and Process simulation.
7) T-test
8) ANOVA
9) Correlation and Regression Analysis
10) Cluster Analysis, Factor Analysis
11) DOE - Response Surface Methodology.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to

1) Perform mathematical calculation such a matrix, graphing and random generations using computer software.
2) Perform some statistical analysis such DOE, ANOVA, Regression and correlation analysis using computer software.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓	✓					
CO2	✓	✓	✓	✓	✓				✓

03OEXXX	FLUID MECHANICS & MACHINERY	L	T	P
		4	0	0

COURSE OBJECTIVES

- To study the applications of the conservation laws to flow through pipes and hydraulic machines.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

Unit–I : Properties of Fluid

Introduction to fluid mechanics -Real and ideal fluids – Properties of fluid – Pressure in a fluid – Manometers — compressible and incompressible fluids – Pressure measurements - Hydrostatic forces on surfaces -Total pressure and Centre of pressure on different surfaces – Buoyancy and static stability – Metacentre.

Unit–II : Flow Characteristics

Types of flows and flow pattern (stream lines, stream tube, Path lines and streak line)– one dimensional flow analysis – General continuity equation – steady flow equation of continuity – Euler's equation- Bernoulli's equation and its applications.(Orifice meter, Venturimeter and pitot tube).

Unit–III : Boundary Layer Concept, Evaluation of Frictional Losses in Pipe and Dimensional Analysis

Boundary layer – laminar and turbulent flow separation – Transition- types of Boundary layer thickness – Flow through pipes- Weisbach equation and chezy's for friction loss in pipe- Major and minor losses – Buckingham ∏ theorem – non – dimensional numbers – Reynolds number – Froude numbers, Weber number, Euler's number and Mach number.

Unit–IV : Turbines

Pressure of a jet a stationary and moving curved blades – impulse and reaction turbines – Pelton wheel – velocity diagram for impulse turbine – hydraulic, mechanical and overall efficiency – reaction turbines – types – Francis and Kaplan turbine – velocity diagrams – draft tubes – specific speed – cavitation.

Unit–V : Pumps

Centrifugal pump – casing – velocity diagrams – manometric and hydraulic efficiency – minimum speed for starting a pump – specific speed. Reciprocating pump – slip and co-efficient of discharge – velocity diagrams – effect of friction and velocity & acceleration on pipes – air vessels – hydraulic appliances.

TEXT BOOKS

1) Bansal, R.K., "A Text Book of Fluid Mechanics and Hydraulic Machinery", Lakshmi Publications, Madras.
2) Modi, P.N., "Hydraulics and Fluid Mechanics", Seth S.M Standard Book House, New Delhi, 1992.

REFERENCE BOOKS

1) Khurmi, R.S., "Fluid Mechanics and Hydraulics Machinery", S. Chand and Co. New Delhi, 1991.
2) Jagdish Lal, "Fluid Mechanics and Hydraulics Machines", Metropolitan Book Co. Pvt. Ltd., New Delhi, 1991.
3) Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (p) Ltd. New Delhi (2004).

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

1) Apply mathematical knowledge to predict the properties and characteristics of a fluid.
2) Critically analyse the performance of pumps and turbines.
3) Identify hydraulic component.
4) Ability to design hydraulic circuits.
5) Visualize how the hydraulic circuit will work to accomplish the function.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓							
CO2	✓	✓	✓	✓					✓
CO3	✓								
CO4	✓		✓	✓					✓
CO5	✓		✓	✓					✓

04OEXXX	**MECHATRONICS FOR AUTOMATION**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To provide basic knowledge about functioning of different control systems, the mechanical and electrical actuation systems.
- To familiarize the students the performance of different types of sensors and transducers, the principle of signal conditioning.
- To illustrate the concepts real time interfacing and advanced application and data acquisition and control systems of mechatronics in manufacturing.

Unit–I

Introduction & Actuation systems: Introduction to Mechatronics System - Elements of measurement system - control systems - open and closed loop - sequential controllers -microprocessor based controllers - Mechatronics approach.

Electrical actuation systems - electrical system - mechanical switches: solid state switches - solenoids - A.C. - D.C Motors - stepper motors.

Unit–II

Mechanical actuation systems - Types of motion - Kinematic chains - cams gear trains - ratchet and pawl - belt and chain drives - bearing - mechanical aspects of

motor selection: Pneumatic and hydraulic actuation systems - directional control valves - pressure control valves - cylinders - process control valves - rotary actuators.

Unit–III

Sensors and Transducers- Performance terminology - static and dynamic characteristics - types - displacement, position and proximity sensors - velocity and motion - fluid pressure - temperature sensors - light sensors - Micro sensors in mechatronics; Signal conditioning- operational amplifier - protection - filtering - wheat stone bridge; digital signals - multiplexers - data acquisitions - data signal processing - pulse modulation.

Unit–IV

Systems and control: Introduction - system representation - Transfer function form - block diagram form - time delays - measurement of system performance - stability - accuracy - transient response - sensitivity. Elementary ideas on control modes, PID controller, digital controller, velocity control, adaptive control – Programmable logic controller, velocity control, adaptive control - Programmable logic controller - basic structure - ladder diagram.

UNIT–V

Real time interfacing and advanced application: Real time interfacing with computer - elements of data acquisition and control system - overview of I/O process. Application - Sensors for conditioning monitoring – mechatronics control in automated manufacturing - online quality monitoring - monitoring of manufacturing processes - supervisory control in manufacturing - inspection - integration of heterogeneous system - artificial intelligence in mechatronics.

TEXT BOOKS

1) Bolton,N., “Electronic Control System for Mechanical and Electrical Engineering Mechatronics”, Longman, 1995.
2) Mechatronics, HMT. Tata McGraw Hill, 1998.

REFERENCE BOOKS

1) Daradaly, D.A., Dawson, D., “Mechatronics - Electronics in Products & Processes”, Burd. N.C. & Hall, 1993.
2) Electro Mechanics - Principles Concepts and Devices Prentice Hall, 1995.
3) Mechatronics system Design - PWS Publishing Company, 1998.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the construction and working principles mechatronis control systems, Electrical and Mechanical actuation systems.
2) Distinguish between sensors and Transducers.
3) Identify suitable mechatronics control system for manufacturing processes.
4) Develop new mechatronics control system for different manufacturing processes.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓				✓				
CO2	✓			✓	✓				
CO3				✓	✓				
CO4				✓	✓				

04OEXXX	**COMPUTER AIDED PRODUCT DESIGN**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the concepts and applications of CAD
- To introduce the various concepts and techniques used for Product design.
- To develop product design skills.

Unit–I

Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

Unit–II

Computer graphics – applications – principals of interactive computer graphics – 2D 3Dtransformations – projections – Beziercurves, B-Spline and NURBS – Concepts.

Unit–III

Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages.

Unit–IV

Product modeling – types of product models; step of product design product development process tools –Design for reliability – design for manufacturability – machining, casting, and metal forming –Design for environment; Bench marking – FMEA - Design for product life cycle.

Unit–V

Product Data Management – concepts – roles and responsibility Collaborative product design and commerce – Information Acquisition – Sourcing factor – manufacturing planning factor – Customization factor – Product life cycle management.

TEXT BOOKS

1) Ibrahim Zeid, “CAD/CAM theory and Practice”, Tata McGraw Hill.
2) Radakrishan, P., Subramaniyan, S., and Raju, V., “CAD/CAM/CIM “, New age International (p) Ltd. Publishers.

REFERENCE BOOKS

1) Biren Prasad, "Concurrent Engineering Fundamentals", Prentice Hall.
2) James G. Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill. David, F., Rogers. J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill.
3) Kevin Otto and Kristin Wood, "Product Design", Pearson Education.

COURSE OUTCOMES

1) Upon completing this course, students should be able to:
2) Understand fundamentals of 2D and 3D drawing.
3) Able to apply Geometric modeling principles of design.
4) Able to manage the product data and apply product life cycle management to Industrial Components.
5) Understand and apply the product modeling.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2		✓	✓						
CO3				✓					
CO4						✓		✓	

04OEXXX	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To provide an understanding of modern techniques and tools of quality management.
- To impart the knowledge and on the application of the statistical quality control techniques which are used in manufacturing and service industries.
- To provide knowledge and understanding of the modern manufacturing strategies and to present a broad conceptual framework for the management of the operations function across the supply chain.

Unit–I

Concepts of TQM – Definition of quality – Dimensions of quality - Deming, Crosby and Juran's philosophies – Barriers to TQM - Quality system – ISO 9000:2000 - ISO 14000 – QS 9000 Quality system standards - Quality costs, Seven tools for Quality Control, Seven tools for Quality management, Quality Function Deployment (QFD) - Taguchi Loss function.

Unit–II

Objectives of statistical quality control - inspection and its importance – Introduction to Single sampling plan – OC Curve - differences between inspection and quality control - Causes and types of variations - Theory of control charts, Control charts for attributes - p, np, c and u charts.

Unit–III

Control charts for variables, $\overline{X}$ - R charts, standard deviation charts - Moving range chart. Relationship between statistical control limits and specification limits - modified control chart, process capability studies (Cp and Cpk) – concept of six sigma.

Unit–IV

Business Process Re-engineering (BPR) – basic concepts – Bench marking: Types – reasons – process of bench marking – overview and approaches to Concurrent engineering – Agile and Lean manufacturing – FMEA – FMECA.

Unit–V

Technology management – Strategic Management – Goal – Vision – Mission statements – order winner – order qualifier - Decision support systems (DSS) – Manufacturing flexibility – Enterprise wide information system (EWIS) – Enterprise resource planning (ERP) – selection of ERP – Product development – SWOT analysis – Value stream mapping – Customer relationship management (CRM) – Database management system (DBMS) – Re-manufacturing.

TEXT BOOKS

1) Montgomery, D.C., "Introduction to Statistical Quality Control", John Wiley, 1994.
2) James Evans, "Managing for Quality and Performance Excellence", CENGAGE Learning, 2014.

REFERENCE BOOKS

1) Gupta, R.C., "Statistical Quality Control", Khanna Publication, 1998.
2) Besterfield, "Total Quality Management", Pearson Education, 2nd Edition, 2003.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Understand the core features of the Total quality management in terms of various dimensions of quality.
2) Measure the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement.
3) Develop an understanding on quality management philosophies and frameworks.
4) Develop the ability to apply the tools of quality control and quality management.
5) Understand proven methodologies to enhance management processes, such as benchmarking and business process reengineering, lean manufacturing.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2		✓							
CO3	✓								
CO4			✓						
CO5				✓					

04OEXXX	**ENGINEERING ECONOMICS**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To introduce the student to the cost implications of the various decisions that may have to be made in a manufacturing environment.

Unit–I

Basic concepts, terms, demand – supply relationship, Role of engineering economics in decision making, Interest calculation (simple & compound), cash (IN/OUT) flows.

Unit–II

Principle of money – Factors and their uses – single payment factors, uniform series present worth factor - capital recovery factor, sinking fund factor present worth, future worth and equivalent uniform annual worth calculation.

Unit–III

Application of money – time relationships: present worth, capitalized cost evaluation, equivalent uniform annual worth calculation, rate of return components for single projects, rate of return evaluation for multiple alternatives.Minimum attractive rate of return.

Unit–IV

Replacement strategies and Policies: Basic concepts of replacement analysis, economic service life, opportunity costs - cash flow approaches to replacement analysis - Replacement analysis using specified study period - probabilistic replacement models.

Unit–V

Cost volume profit relationship – relevant costs in decision making – profit management analysis - aluation, alternative selection by cost-benefit break-even analysis and its application, payback period. Depreciation methods: straight line, declining balance, sinking fund - Depletion models – cost depletion, percentage depletion methods.

TEXT BOOKS

1) Leland Blank, T., and Anthony J. Tarquin, “Engineering Economy”, McGraw Hill, Singapore, 4th Edition 1998.
2) Riggs, J.L., Bedworth, J.A., and Randhava, S.U., “Engineering Economics”, McGarw Hill, 1998.

REFERENCE BOOKS

1) Degarmo, E.P., Sullaivan, W.G., and Bontadelli,J.A., "Engineering Economics", Macmillan Pub. Co., New York, 1993.
2) Stenier, H.M., "Engineering Economics Principle", McGraw Hill, New York, 1992.
3) Thuesen, G.J., and Fabrycky, W.J., "Engineering Economics", Prentice Hall International, New Jersey, 1993.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓							✓	
CO2								✓	
CO3		✓	✓					✓	

04OEXXX	**SENSORS AND CONTROL SYSTEMS IN MANUFACTURING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To equip the students with concepts of sensor performance, product monitoring and control applications in robotics.
- To acquaint the student with the elements of CIM, FMS and the integration of manufacturing functions.
- To provide students with a sound understanding of the use of advance instrumentation and sensing methods.
- Understand the various components of sensor network architecture, networks in manufacturing and PLC.
- To provide an exposure to current trends in areas related to fiber optics in sensor and biomedical technology.

Unit–I

Sensor Fundamental , Classification and Types of Sensors, Desirable Sensor Attributes, Sensor Performance and Power dissipation -a trade off, Self-Checking and Self Compensating Sensors- Sensor for Work Pieces and Product Monitoring.

Unit–II

Identification of Manufactured Components, Digital Encoders, Opto Electronic Color Sensors - Principles, Properties, Features and Control Applications in Robotics.

Unit–III

Design of CIM, Decision Support System for CIM, Analysis and Design of CIM, and Development of CIM Strategy with Sensor and Control. FMS- Robot Control with Vision Sensors, Multi Sensor Controlled Robots, Measurement of Robot Density, Robot Programming.

Unit–IV

Sensor Network Architecture , Sensor Tracking, Sensors to Detect Machinery Faults, Networks in Manufacturing, Computer Communications- Interface of Sensors With Single Board Computer for PLC, and Numerical Control. Networking with Electro Optic Link using Fiber Sensors.

Unit–V

Fiber Optics in Sensor and Control System.- Fibre Optics Parameters, Configurations, Photo Electric Sensor for Long Distance, Sensor Alignment Techniques, Sensors for Biomedical Technology.

TEXT BOOKS

1) Sabrie Soloman, "Sensors and Control systems in manufacturing", McGraw Hill Publications, 2th edition 2010.

REFERENCE BOOKS

1) Tonshoff, H.K., and Inasaki, I., "Sensor Applications, vol. 1 sensors in Manufacturing", Wileyvch Publications 2001.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1) Learn the basics of sensor requirement in product monitoring.
2) Provide an introduction to condition monitoring procedures and system integration
3) Know about Identification of manufactured Components and applications in Robotics.
4) Provide understanding of the use of advanced instrumentation and sensing methods.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓				✓				
CO2				✓					✓
CO3		✓	✓					✓	

03OEXXX	**AUTOMOTIVE ENGINEERING**	**L**	**T**	**P**
		4	**0**	**0**

COURSE OBJECTIVES

- To impart the knowledge about the engine chassis, transmission, steering, suspension systems, rear axles and final drive of Automobiles.
- To Study the concept of electrical system, sensors and fuel injection system in automobiles

Unit–I

Engine chassis frame – layout of chassis and its main components – functions of the chassis frame – types – laden – monocoque – various loads acting on the

chassis frame. The Clutch - Function- Single plate, multi plate clutches - Torque converters.

Unit–II

Gear Boxes - Function – Sliding mesh - Constant mesh and synchromesh gear boxes - Selector Mechanism – Working of Automatic gear boxes - over drive - Front wheel drive - Propeller shaft and universal joints - Constant velocity Universal joints.

Unit–III

Front axle and steering geometry - Principle of power steering - steering mechanism – Re-circulating ball mechanism - cam & double pin steering gear boxes - Camber angle, Caster angle, King pin inclination - Types of frames and suspension systems. Independent suspension - Rear suspension - Pneumatic suspension.

Unit–IV

Rear axle - final drive - Single and double reduction axle, torque and thrust members - arrangements. Differential - function of differential - differential lock - rear axle-housing construction - Rear axle arrangements. Brakes - Mechanical, disc, hydraulic and pneumatic brakes - servo brakes – antilock braking systems.

Unit–V

Electrical system of the automobile - Battery – Ignition system - Gasoline injection- throttle body injection and multi point fuel injection systems- controls –– CRDI system for diesel engine. Engine sensors - types– oxygen sensors, crank angle position sensors – fuel metering, vehicle speed sensors - detonation sensor – altitude sensor, flow sensor, throttle position sensors, relays. GPS navigation system.

TEXT BOOKS

1) William, H., Crouse and Donald L. Anglin, “Automotive Mechanics”, Tata McGraw Hill, 10th Edition 2004.
2) Gupta, R.B., “Automobile Engineering”, Sathya Prakasam New Market, New Rohta road, New Delhi.

REFERENCE BOOKS

1) Bosch, “Automotive Handbook”, Robert Bosch GmbH, Germany, 2004, Sixth Edition.
2) John B. Heywood, “Internal Combustion Engines”, McGraw-Hill.
3) Newton & Steeds, “Motor Vehicles”. Butterworth-Heinemann 13th edition.
4) Hillier, “V.M., Fundamentals of Motor Vehicle technology”. Nelson Thornes, 5th edition.
5) Heitner, Automobile Engines.
6) Rober Bosch GMBH “Automotive Electrics Automotive Electronics Systems and Components”, New-Networking, Hybrid drive 5th edition.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

1) Identify the different systems in an automobile
2) Understand different auxiliary, sensors, fuel injection and transmission systems in automobiles.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓								
CO2	✓			✓					
CO3	✓				✓				
CO4	✓			✓	✓				
CO5			✓	✓	✓				

08OEXXX	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**
		4	**-**	**-**

COURSE OBJECTIVES

- The course acts as a bridge between engineering and biology to provide basic understanding of biological mechanisms of living systems from engineering perspective.
- It will illustrate the many possible means to utilize living things' relevance to engineering principles.
- With substantial knowledge and continuing interest will make a student into a specialist in the technical diversity.

Unit–I : Requirements of Biological Systems

Biological Units Need Water; Biological Units Need the Right Amount of Oxygen; Biological Units Need Food and Nutrients; Biological Units Become Ill in the Presence of Wastes; Biological Units Need Heat Sources and Sinks.

Unit–II : Behaviour of Biological Systems

Biological Units Adapt to Their Environments; Biological Units Modify Their Environments; Adaptations Require Extra Energy and Resources; Biological Units, If Possible, Move to Friendlier Environments; Biological Units Evolve under Environmental Pressures.

Unit–III : Response to Stress by Biological Systems

Crowding of Biological Units Produces Stress; Biological Units Are Affected by Chemical Stresses; Biological Units Respond to Mechanical Stresses; Optimization Is Used to Save Energy and Nutrient Resources; Biological Units Alter Themselves to Protect against Harsh Environments.

Unit–IV : Existence of Biological Systems

Biological Units Cooperate with Other Biological Units; Biological Units Compete with Other Biological Units; Biological Units Reproduce; Biological Units Coordinate Activities through Communication; Biological Units Maintain Stability with

Exquisite Control; Biological Units Go through Natural Cycles; Biological Units Need Emotional Satisfaction and Intellectual Stimulation; Biological Units Die.

Unit–V : Scaling Factors and Biological Engineering Solutions

Allometric Relationships from Evolutionary Pressure; Dimensional Analysis; Golden Ratio; Fractal Scaling within an Organism; Self-Similarity for Tissues and Organs; Self-Similarity in Populations; Systems Approach; Relationships between Engineering and Biology; The Completed Design.

TEXT BOOKS

1) Arthur T. Johnson, "Biology for Engineers", CRC Press, 2010.

REFERENCE BOOKS

1) Aydin Tözeren, Stephen W. Byers, New Biology for Engineers and Computer Scientists, Pearson/Prentice Hall, 2004
2) S. Thyaga Rajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012.

COURSE OUTCOMES

3) The ability to understand the information known about familiar living systems.
4) The ability to anticipate the properties of an unfamiliar group of living things from knowledge about a familiar group.
5) The ability to demonstrate the relevance of engineering to biological systems.
6) The knowledge about the biological responses and it is scaling with respect to scientific principles that cannot be related back.
7) The knowledge of biological principles and generalizations that can lead to useful products and processes.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓				✓				
CO2	✓								
CO3		✓	✓	✓					
CO4				✓			✓		
CO5			✓			✓			✓

02OEXXX	**DISASTER MANAGEMENT**	**L**	**T**	**P**
		4	**-**	**-**

COURSE OBJECTIVES

- This course helps in providing the basic concepts of disasters and also gives a thorough knowledge and experience to reduce disaster risks.

Unit–I

Introduction – Disaster - Characteristics and types of Disasters - Causes and effects of Disaster – Risk - Vulnerability – Preparedness - Disaster mitigation and disaster management - Classification of mitigation measures - Vulnerability

Analysis - Observation and Perception of Vulnerability – Socio - Economic Factors of Vulnerability - Vulnerability in India - Disaster related policy goals of UNDP UNDRO and Govt. of India - Appraising disaster needs - Needs for technical expertise - Role of various Agencies in Disaster Management and Development - Disaster risk reduction planning - Role of Developmental Planning for disaster Management.

Unit–II

Earthquake - Cause of Earthquake- General characteristics - Measuring Earthquakes - Distribution pattern of Earthquakes in India - Earthquake prone areas- case studies of important Indian earthquakes - Forecasting techniques and risk analysis - Possible risk reduction measures - earthquake resistance buildings and re-engineering techniques in India.

Unit–III

Tsunamis- Causes of a Tsunami- General Characteristics- Tsunami warning system-Distribution pattern of Tsunami in India- Possible risk reduction measures-Integrated coastal zone management.

Landslides- Rock falls- Avalanches- Mud flows and glaciers- Landslides and rock falls - landslide hazard zonation- Instrumentation and monitoring- Techniques for reducing landslide hazards.

Unit–IV

Tropical cyclones- Structure of tropical cyclones- Nature of tropical cyclones-Cyclone experience in India and Tamilnadu- Preparedness- Tropical cyclones and their warning systems- Tropical cyclone warning strategy in India special nature of the problem in the region- Classification- Protection of buildings from cyclones of India- Precautions during and before cyclones.

Unit–V

Coastal floods- Intensification of hazards due to human interference-Management-River and coastal floods- Temperature extremes and wild fires-Physiological hazards- Flood forecasting-mitigation- planning- management- flood prone areas the Indian scenario- Flood experience in India and Tamilnadu.

Environmental hazards- Typology- Assessment and response- Strategies -The scale of disaster-Vulnerability- Disaster trends- Paradigms towards a balanced view- Chemical hazards and toxicology-Biological hazards- Risk analysis- Other technological disasters.

TEXT BOOKS

1) David R. Godschalk (Editor), Timothy Beatiey, Philip Berke,.David J. Browt:r, Edward J. Kaiser Charles C. Boh, R. Matthew Goebel, Natural Hazard Mitigation: Recasting Disaster Policy and Planning Island Press; (January 1999), ISBN) 559636025.

2) Sinha, P.C. Wind & Water Driven Disasters, 1998, 250pp, Anmol Publications.

REFERENCE BOOKS

1) Davide Wikersheimer Windstorm Mitigation Manual for Light Frame Construction, DIANE Publishing Co: (Paperback-May 1997).
2) Brown D Redevelopment After the Storm: Hazard Mitigation Opportunities in the Post Disater Setting. (Paperback – June 1985) Publisher: John Wiley & Sons ISBN:047191505X.
3) Sinha, P.C. Technological Disasters , 1997, 516 pp Anmol Publications Trivedi,

COURSE OUTCOMES

1) Develop an understanding of the key concepts, definitions key perspectives of all Hazards Emergency Management.
2) Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓		✓	✓	✓	✓			
CO2					✓	✓	✓	✓	✓

02OEXXX	**ENTREPRENEURSHIP**	**L**	**T**	**P**
		4	**-**	**-**

COURSE OBJECTIVES

- Develop an entrepreneurship sprit.
- Help to identify business opportunities within an organization or independently.
- Initiate action on the business plan from the prospective business through EDC.

Unit–I

Meaning – Characteristics of management – Nature of management – Process of management – Functional areas of management – Management and administration – Role of management – Level of management – Evolution of management.

Unit–II

Meaning - Nature of planning – Importance of planning – Types of planning – Steps in planning – Decision making – Meaning and definition of organizing – Steps in organizing – Nature of organization – Organization structure – Purpose of organization – Principles of organization – Delegation of authority – Nature and importance of staffing.

Unit–III

Meaning and nature of direction – Principles of directing – Leadership and leadership style – Motivation – Communication – Need and feedback in communication – Importance of communication – Channels of communication – Types of communication – Forms of communication.

Unit–IV

Evolution of concept of entrepreneur – Concept of entrepreneur – Characteristics of entrepreneur – Distinction between entrepreneur and manager – Technical entrepreneur – Charms of being an entrepreneur – Types of entrepreneur – Role of entrepreneurship in economic development – Barriers in entrepreneurship.

Unit–V

Meaning of project – Project classification – Project identification – Meaning and significance of project report – Contents of a project report – Formulation of project report – Planning commission guidelines – Identification of opportunity – Project feasibility study.

TEXT BOOKS

1) Veerabhadrappahavinal, Management and Entrepreneurship, New Age International, New Delhi, 2008.
2) Peter f. Drucker; Innovation and entrepreneurship, Butterworth – Heinemann, London, 1985.

REFERENCE BOOKS

1) "Creativity, innovation, entrepreneurship and enterprise in construction and development", University of Reading, Alan Barrell – Entrepreneur in Residence Entrepreneur in Residence, University of Xiamen, Xiamen 2012.
2) "Entrepreneurship Studies", National University Commission (Nigerian University System), 2010.

COURSE OUTCOMES

At the end of this course the student should have,

1) An understanding about entrepreneurship.
2) Knowledge about the principles of business Plan.

Mapping with Programme Outcomes									
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	✓	✓	✓	✓		✓	✓	✓	✓
CO2			✓		✓	✓	✓	✓	✓

02OEXXX	**NATIONAL SERVICE SCHEME**	**L**	**T**	**P**
		4	**-**	**-**

COURSE OBJECTIVES

- Understand the community in which they work and their relation.
- Identify the needs and problems of the community and involve them in problem-solving.
- Develop capacity to meet emergencies and natural disasters.
- Practice national integration and social harmony and
- Utilize their knowledge in finding practical solutions to individual and community problems.

Unit–I : National Service Scheme

a. History and its Objectives
b. Organizational structure of N.S.S. at National, State, University and College Levels
c. Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

Unit–II : National Integration

a. Need of National integration
b. Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc.

Unit–III : Special Programme

a. Legal awareness
b. Health awareness
c. First-aid
d. Career guidance
e. Leadership training - cum - Cultural Programme
f. Globalization and its Economic Social Political and Cultural impacts.

Unit–IV : Special Camping Programme

a. Nature and its objectives
b. Selection of camp site and physical arrangement
c. Organization of N.S.S. camp through various committees and discipline in the camp.
d. Activities to be undertaken during the N.S.S. camp.
e. Use of the mass media in the N.S.S. activities.

Unit–V : N.S.S. Regular Activities

a. Traffic regulation
b. Working with Police Commissioner's Office
c. Working with Corporation of Chennai
d. Working with Health Department
e. Blind assistance
f. Garments collection
g. Non-formal education
h. 'Environmental Education, Awareness and Training (EEAT)'
i. Blood donation

REFERENCE BOOKS

1) National Service Scheme Manual, Government of India, 2006.
2) Training Programme on National Programme scheme, TISS.
3) Orientation Courses for N.S.S. Programme officers, TISS.
4) Case material as Training Aid for field workers, Gurmeet Hans.
5) Social service opportunities in Hospitals, Kapil K. Krishan, TISS.
6) Social Problems in India, Ram Ahuja.

02EXXX	HUMAN RIGHTS	L	T	P

		4	**-**	**-**

COURSE OBJECTIVES

- At the end of this course the student is expected to understand what is human rights, how to obey the rights, what is the role of a human being in making a good society for the future generations.

Unit–I

Definition of Human Rights - Nature, Content, Legitimacy and Priority - Theories on Human Rights - Historical Development of Human Rights.

Unit–II

International Human Rights - Prescription and Enforcement upto World War II - Human Rights and the U .N .O. - Universal Declaration of Human Rights - International Covenant on Civil and Political Rights - International Convenant on Economic, Social and Cultural Rights and Optional Protocol.

Unit–III

Human Rights Declarations - U.N. Human Rights Declarations - U.N. Human Commissioner.

Unit–IV

Amnesty International - Human Rights and Helsinki Process - Regional Developments -European Human Rights System - African Human Rights System - International Human Rights in Domestic courts.

Unit–V

Contemporary Issues on Human Rights: Children's Rights - Women's Rights - Dalit's Rights - Bonded Labour and Wages - Refugees - Capital Punishment. Fundamental Rights in the Indian Constitution - Directive Principles of State Policy - Fundamental Duties - National Human Rights Commission.

TEXT BOOKS

1) Desai, A.R. Violation of Democratic Rights in India, Sage Publishers, 1986.
2) S. Hick, E. Halpin and E. Hoskins, Human Rights and the Internet, Springer Publishers, 2000.

REFERENCE BOOKS

1) International Bill of Human Rights, Amnesty International Publication, London, 1988.
2) Human Rights, Questions and Answers, UNESCO, 1982
3) Mausice Cranston- What is Human Rights
4) Timm. R.W. - Working for Justice and Human Rights.
5) Human Rights, A Selected Bibliography, USIS.
6) Cheous K (Ed) - Social Justice and Human Rights (Vols 1-7).
7) Devasia, V.V. - Human Rights and Victimology.

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