

SCHEME and SYLLABUS
(Choice Based Credit Scheme)

for

BACHLOR OF TECHNOLOGY PROGRAMME

in

MECHANICAL ENGINEERING

(w.e.f. session 2017-2018)



DEPARTMENT OF MECHANICAL ENGINEERING
YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD



YMCA University of Science and Technology, Faridabad

(A Haryana State Government University)

(Established by Haryana State Legislative Act No. 21 of 2009 & Recognized by UGC Act 1956 u/s 22 to Confer Degrees)

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.



Department of Mechanical Engineering

VISION

To be a centre of excellence by producing high caliber, competent and self-reliant mechanical engineers, who possess scientific temperament and would engage in activities relevant to industries with ethical values and flair to research.

MISSION

- To provide efficient engineers for global requirements by imparting quality education.
- To explore, create and develop innovations in various aspects of engineering through industries and institutions.
- To emphasize on practical skills and socially relevant technology.

ABOUT THE PROGRAM

YMCA University of Science & Technology, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, was established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized fields of engineering to meet specific technical manpower requirements of industries. Mechanical Engineering Department was started in 1969 and has been conducting B.Tech Course in Mechanical Engineering of 4-Years duration since 1997. Students are admitted through centralized counseling nominated by state government in 1st Year and 2nd year through lateral entry entrance test. The total intake for the B.Tech programme is 120 and 24 through LEET in second year. Besides under graduate degree courses, it is also running M.Tech Mechanical Engineering Course (with specialization in Manufacturing Technology and Automation) and Ph.D. All courses are duly approved by AICTE/ UGC. The Mechanical Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has four storey building with 08 class rooms, 14 laboratory, three workshops, twelve offices, Seminar Hall and Conference Hall. It has established Centre of Excellence with Danfoss Industries (P) Ltd in the area of 'Climate and Energy' and one with Daikin in the field of 'Refrigeration and Air Conditioning'. It has excellent faculty with 10 Professors, 03 Associate Professors and 16 Assistant Professors. The various syllabi of UG/PG courses in Mechanical Engineering Department, has been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. Seven month training is mandatory for every B.Tech student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1:

To train students with practical skills and experimental practices related to core and applied areas of mechanical engineering to expand their knowledge horizon beyond books..

PEO-2:

To enable students to design, develop and maintain mechanical equipments which are useful for the society.

PEO-3:

To improve team building, team working and leadership skills of the students with high regard for ethical values and social responsibilities.

PEO- 4:

To enable students to communicate effectively and demonstrate the knowledge of project management and independent research.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

- 1) Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of engineering problems.
- 2) Problem Analysis:** Identify, formulate, review literature and analyze mechanical engineering problems to design, conduct experiments, analyze data and interpret data.
- 3) Design /Development of Solutions:** Design solution for mechanical engineering problems and design system component of processes that meet the desired needs with appropriate consideration for the public health and safety, and the cultural, societal and the environmental considerations.
- 4) Conduct Investigations of Complex Problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in mechanical engineering.
- 5) Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to mechanical engineering activities with an understanding of the limitations.
- 6) The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to mechanical engineering practice.
- 7) Environment and Sustainability:** Understand the impact of the mechanical engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
- 8) Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the mechanical engineering practice.
- 9) Individual and Team Work:** Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in mechanical engineering.
- 10) Communication:** Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as, being able to comprehend and write affective reports and design documentation, make effective presentations in mechanical engineering.
- 11) Project Management and Finance:** Demonstrate knowledge & understanding of the mechanical engineering principles and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments in mechanical engineering.

12) Life - Long Learning: Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest context of technological changes in mechanical engineering.

PROGRAM SPECIFIC OUTCOMES (PSOs):

- 1) To apply practical skills, knowledge of engineering fundamentals and mechanical engineering, to industries and institutions.
- 2) To explore, create and develop innovations in various aspects of engineering. The student will be ready to take-up career or to pursue higher studies with high regard to ethical values and social responsibilities.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SYNOPSIS OF

SCHEME OF STUDIES & EXAMINATIONS

4 YEARS BACHELOR of TECHNOLOGY PROGRAMME IN

MECHANICAL ENGINEERING

SEMESTER I – VIII

(w.e.f. Session 2017-18)

B. TECH SCHEME CREDITS CALCULATIONS

S.No.	Category of Courses	Contact Hours	Credits
1.	Programme Core Courses (PCC)	96	83
2.	Ability Enhancement Compulsory Courses (AECC)	10	8
3.	Skill Enhancement Courses (SEC)	50	35
4.	Discipline Specific Elective Courses (DSE)	15	15
5.	General elective Courses (GEC)	9	9
6.	Basic Science Courses (BSC)	28	25
7.	Basic Engineering Courses (BEC)	22	17
8.	Mandatory Audit Courses (MAC)	4	0
9.	Massive Open Online Courses (MOOCS)	0	4
	Total	234	196

Note: 1. MOOCS course will be opted by students any time during from III to VI semester of their B. Tech programme.

SEMESTER WISE SUMMARY OF THE PROGRAMME

S.No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	32	850	26
2.	II	35	900	26
3.	III	37	900	28
4.	IV	37	900	28
5.	V	30	800	25
6.	VI	33	900	26
7.	VII	One Semester	500	10
8.	VIII	30	700	23
	Total	234	6450	192
	Total with MOOCS		6550	196

Note: Four credits for the MOOCS course are to be earned in any semester from III to VI.

PROGRAMME CORE COURSES (PCC)

S.No.	Code	Name of the Course	No. of Contact Hours	No. of Credits	Semester
1.	ME-201C	Mechanics of Solids	3	3	III
2.	ME-203C	Fluid Mechanics	4	4	III
3.	ME-205C	Engineering Mechanics	4	4	III
4.	ME-207C	Thermodynamics	4	4	III
5.	ME-209C	Manufacturing Processes	3	3	III
6.	ME-251C	Mechanics of Solids Lab	2	1	III
7.	ME-253C	Fluid Mechanics Lab	2	1	III
8.	ME-255C	Machine Drawing using AutoCAD	4	2	III
9.	ME-202C	Kinematics of Machines	3	3	IV
10.	ME-204C	Material Science and Engineering	4	4	IV
11.	ME-206C	Internal Combustion Engines	4	4	IV
12.	ME-208C	Fluid Machines	3	3	IV
13.	ME-210C	Manufacturing Technology and Metrology	3	3	IV
14.	ME-212C	Advanced Strength of Materials	4	4	IV
15.	ME-252C	Kinematics of Machines Lab	2	1	IV
16.	ME-254C	Material Science and Engineering Lab	2	1	IV
17.	ME-256C	Internal Combustion Engines Lab	2	1	IV
18.	ME-258C	Fluid Machines Lab	2	1	IV
19.	ME-301C	Dynamics of Machines	4	4	V
20.	ME-303C	Refrigeration and Air-Conditioning	4	4	V
21.	ME-305C	Industrial Engineering	3	3	V
22.	ME-307C	Machine Design -1	3	3	V
23.	ME-351C	Dynamics of Machines Lab	2	1	V
24.	ME-353C	Refrigeration and Air-Conditioning Lab	2	1	V
25.	ME-302C	Heat and Mass Transfer	4	4	VI
26.	ME-304C	Computer Aided Design	3	3	VI
27.	ME-306C	CAM and Automation	3	3	VI
28.	ME-308C	Machine Design – II	3	3	VI
29.	ME-352C	Heat and Mass Transfer Lab	2	1	VI
30.	ME-354C	Computer Aided Design Lab	2	1	VI
31.	ME-356C	CAM and Automation Lab	2	1	VI
32.	ME-402C	Operations Research	4	4	VIII
		Total	96	83	

ABILITY ENHANCEMENT COMPULSARY COURSES (AECC)

S.No.	Code	Name of Course	No. of Contact Hours	Credits	Semester
1.	HAS-107C	Environmental Science	3	3	I
2.	HAS-109C	Essentials of Communications	3	3	II
3.	HAS-159C	Language Lab	2	1	II
4.	ME-358C	Presentation Skill Development	2	1	VI
		Total	10	8	

SKILL ENHANCEMENT COURSES (SEC)

S.No.	Code	Name of Course	No. of Contact Hours	Credits	Semester
1.	WS-161C	Workshop I	6	3	I
2.	WS-162C	Workshop II	6	3	II
3.	WS-261C	Workshop III	6	3	III
4.	WS-262C	Workshop IV	6	3	IV
5.	WS-361C	Workshop V	6	3	V
6.	WS-362C	Workshop VI	6	3	VI
7.	ME-401C	Industrial Training	One semester	10	VII
8.	WS-462C	Workshop VII	6	3	VIII
9.	ME-452C	Project	8	4	VIII
		Total	50	35	

DISCIPLINE SPECIFIC ELECTIVE (DSE)

S.No.	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	Discipline Specific Elective I	3	3	V
2.	Discipline Specific Elective II	3	3	VI
3.	Discipline Specific Elective III	3	3	VI
4.	Discipline Specific Elective IV	3	3	VIII
5.	Discipline Specific Elective V	3	3	VIII
	Total	15	15	

GENERAL ELECTIVE COURSE (GEC)

S.No.	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	General Elective Course I	3	3	V
2.	General Elective Course II	3	3	VI
3.	General Elective Course III	3	3	VIII
	TOTAL	9	9	

BASIC SCIENCE COURSES (BSC)

S.No.	Code	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	HAS-101C	Physics-I	4	4	I
2.	HAS-103C	Mathematics-I	4	4	I
3.	HAS-105C	Chemistry	3	3	I
4.	HAS-151C	Physics Lab-I	2	1	I
5.	HAS-155C	Chemistry Lab	2	1	I
6.	HAS-102C	Physics-II	4	4	II
7.	HAS-104C	Mathematics-II	4	4	II
8.	HAS-152C	Physics Lab-II	2	1	II
9.	ME-211C	Numerical Methods	3	3	III
		Total	28	25	

BASIC ENGINEERING COURSES (BEC)

S.No.	Code	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	EC-101C	Elements of Electronics Engineering	3	3	I
2.	ME-101C	Basics of Mechanical Engineering	3	3	I
3.	ME-151C	Basics of Mechanical Engineering Lab	2	1	I
4.	EE-101C	Basic Electrical Engineering	3	3	II
5.	CE-101C	Fundamentals of Computers & Programming with C	3	3	II
6.	EE-151C	Basic Electrical Engineering Lab	2	1	II
7.	CE-151C	Fundamentals of Computers & Programming with C Lab	2	1	II
8.	ME-152C	Engineering Drawing	4	2	II
		Total	22	17	

DISCIPLINE SPECIFIC ELECTIVE COURSE-I (DSE-I) (Semester-V)

S.No.	Code	Name of Course	Contact Hours	Credits
1	ME-309C	Principles of Management	3	3
2.	ME-311C	New Venture Creation	3	3
3.	ME-313C	Welding Technology	3	3
4.	ME-315C	Aircraft Engine Operation and Maintenance	3	3
5.	ME-317C	Metallurgy	3	3

Note: Students will have to select any one out of the list.

DISCIPLINE SPECIFIC ELECTIVE COURSE-II (DSE-II) (Semester-VI)

S.No.	Code	Name of Course	Contact Hours	Credits
1.	ME-310C	Industrial Management	3	3
2.	ME-312C	Applied Thermodynamics	3	3
3.	ME-314C	Tool Design	3	3
4.	ME-316C	Automobile Engineering	3	3
5.	ME-318C	Design of Thermal Systems	3	3

Note: Students will have to select any one out of the list.

DISCIPLINE SPECIFIC ELECTIVE COURSE-III (DSE-III) (Semester- VIII)

S.No.	Code	Name of Course	Contact Hours	Credits
1.	ME-404C	Mechatronics	3	3
2.	ME-406C	Production Planning and Control	3	3
3.	ME-408C	Industrial Controls	3	3
4.	ME-410C	Machine Tool Technology	3	3
5.	ME-412C	Estimation and Design of RAC Plants	3	3

Note: Students will have to select any one out of the list.

DISCIPLINE SPECIFIC ELECTIVE COURSE-IV (DSE-IV) (Semester- VIII)

S.No.	Code	Name of Course	Contact Hours	Credits
1.	ME-414C	Flexible Manufacturing System	3	3
2.	ME-416C	Project Management	3	3
3.	ME-418C	Tribology	3	3
4.	ME-420C	Air Conditioning Equipments	3	3
5.	ME-422C	Non Conventional Energy Resource Utilization	3	3

Note: Students will have to select any one out of the list.

DISCIPLINE SPECIFIC ELECTIVE COURSE-V (DSE-V) (Semester-VIII)

S.No.	Code	Name of Course	Contact Hours	Credits
1.	ME-424C	Micro and Nano Manufacturing	3	3
2.	ME-426C	Quality Management	3	3
3.	ME-428C	Design and Optimisation	3	3
4.	ME-430C	Power Plant Engineering	3	3
5.	ME-432C	Advanced Manufacturing Processes	3	3

GENERAL ELECTIVE COURSES- I, II and III (Semester- V, VI and VIII respectively)

Students have to select three different General Elective Courses-I, II &III from the given list:

Courses offered by Computer Engineering Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GC-101C	Intelligent Systems	3	3
2.	GC-102C	Cyber laws and Security	3	3
3.	GC-103C	Soft Computing	3	3
4.	GC-104C	Web Technology and Information Retrieval	3	3
5.	GC-105C	Intellectual Property and Rights	3	3

Courses offered by Electrical Engineering Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GL-201C	Installation Testing & Maintenance of Electrical Equipments	3	3
2.	GL-202C	Utilization of Electrical Power & Traction	3	3

Courses offered by Electronics Engineering Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GE-401C	Microprocessor and Interfacing	3	3
2.	GE-402C	Digital Signal Processing	3	3
3.	GE-403C	Instrumentation and Control	3	3
4.	GE-404C	Data Communication and Networking	3	3

Courses offered by HAS Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GA-501C	Soft Skills for Engineers	3	3
2.	GA-502C	Maths –III	3	3

Courses offered by MBA Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GB-601C	Human Resource Management	3	3
2.	GB-602C	Financial Management	3	3
3.	GB-603B	Marketing Management	3	3
4.	GB-604B	Entrepreneur Development	3	3
5.	GB-605B	Principles of Management and Economics	3	3

MANDARORY AUDIT COURSES (Semester- III and IV respectively)

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	AC-101C	German- I	2	0
2.	AC-102C	German –II (With German – I as prerequisite)	2	0
3.	AC-103C	French – I	2	0
4.	AC-104C	French –II (With French – I as prerequisite)	2	0
5.	AC-105C	Sanskrit – I	2	0
6.	AC-106C	Sanskrit – II (With Sanskrit– I as prerequisite)	2	0
7.	AC-107C	Personality Development	2	0
8.	AC-108C	Interview and Group Discussion Skills	2	0
9.	AC-109C	Yoga and Meditation	2	0
10.	AC-110C	Art of Living/ Living Skills	2	0
11.	AC-111C	Contribution of NSS towards Nation/Role of NSS	2	0
12.	AC-112C	Physical Education	2	0

Note: Students will have to select any two out of the list.

GRADING SCHEME

Marks %	Grade	Grade points	Category
90-100	O	10	Outstanding
80<marks<90	A+	9	Excellent
70<marks< 80	A	8	Very good
60<marks< 70	B+	7	Good
50<marks< 60	B	6	Above average
45<marks< 50	C	5	Average
40<marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

MINIMUM CREDITS TO BE EARNED FOR DIFFERENT COURSE FOR QUALIFYING FOR THE B.TECH IN MECHANICAL ENGINEERING

S.N.	Category of Courses	Abbreviation	Credits Offered		Minimum Credits to be Earned
1.	Programme Core Course	PCC	(≥ 80)	83	83
2.	Ability Enhancement Compulsory Course	AECC	(≥ 06)	08	08
3.	Skill Enhancement Course	SEC	(≥ 32)	35	35
4.	Discipline Specific Electives	DSE	(≥ 15)	15	12
5.	General Elective Course	GEC	(≥ 06)	09	06
6.	Basic Science Course	BSC	(≥ 20)	25	25
7.	Basic Engineering Course	BEC	(≥ 15)	17	17
8.	Mandatory Audit Course	MAC	0	0	0
9.	Massive Open Online Courses	MOOCS	4	4	4
	TOTAL		≥ 178	196	190

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1st YEAR (SEMESTER -I) CE/ IT/ MECH ENGINEERING (2017-2018)

Course No.	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	P	TOTAL		Theory	Practical			
HAS-101C	Physics-I	4	-	4	25	75	-	100	4	BSC
HAS-103C	Mathematics-I	4	-	4	25	75	-	100	4	BSC
HAS-105C	Chemistry	3	-	3	25	75	-	100	3	BSC
HAS-107C	Environmental Science	3	-	3	25	75	-	100	3	AECC
EC-101C	Elements of Electronics Engg.	3	-	3	25	75	-	100	3	BEC
ME-101C	Basics of Mechanical Engg.	3	-	3	25	75	-	100	3	BEC
HAS-151C	Physics Lab-I	-	2	2	15	-	35	50	1	BSC
HAS-155C	Chemistry Lab	-	2	2	15	-	35	50	1	BSC
ME-151C	Basics of Mechanical Engineering Lab	-	2	2	15	-	35	50	1	BEC
WS-161C	Workshop-I	-	6	6	30	-	70	100	3	SEC
	Total	20	12	32	225	450	175	850	26	

Note: Exams duration will be as under

- (a) Theory exams will be of 03 hours duration.
- (b) Practical exams will be of 02 hours duration
- (c) Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1st YEAR (SEMESTER -II) CE/ IT/ MECH ENGINEERING (2017-2018)

Course No.	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	P	Total		Theory	Practical			
HAS-102C	Physics-II	4	-	4	25	75	-	100	4	BSC
HAS-104C	Mathematics-II	4	-	4	25	75	-	100	4	BSC
HAS-109C	Interactive English	3	-	3	25	75	-	100	3	AECC
EE-101C	Basic Electrical Engineering	3	-	3	25	75	-	100	3	BEC
CE-101C	Fundamentals of Computer & Programming with C	3	-	3	25	75	-	100	3	BEC
HAS-152C	Physics Lab-II	-	2	2	15	-	35	50	1	BSC
CE-151C	Fundamentals of Computer & Programming with C Lab	-	2	2	15	-	35	50	1	BEC
EE-151C	Electrical Technology Lab	-	2	2	15	-	35	50	1	BEC
HAS-159C	Language lab	-	2	2	15	-	35	50	1	AECC
ME-152C	Engineering Drawing	-	4	4	30	-	70	100	2	BEC
WS-162C	Workshop- II	-	6	6	30	-	70	100	3	SEC
	Total	17	18	35	245	375	280	900	26	

Note: Exams duration will be as under

- (a) Theory exams will be of 03 hours duration.
- (b) Practical exams will be of 02 hours duration
- (c) Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – III) MECHANICAL ENGINEERING (2017-18)

Course No.	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
ME-201C	Mechanics of Solids	3	-	-	3	25	75	-	100	3	PCC
ME-203C	Fluid Mechanics	3	1	-	4	25	75	-	100	4	PCC
ME-205C	Engineering Mechanics	3	1	-	4	25	75	-	100	4	PCC
ME-207C	Thermodynamics	3	1	-	4	25	75	-	100	4	PCC
ME-209C	Manufacturing Processes	3	-	-	3	25	75	-	100	3	PCC
ME-211C	Numerical Methods	3	-	-	3	25	75	-	100	3	BSC
ME-251C	Mechanics of Solids Lab	-	-	2	2	15	-	35	50	1	PCC
ME-253C	Fluid Mechanics Lab	-	-	2	2	15	-	35	50	1	PCC
ME-255C	Machine Drawing using AutoCAD	-	-	4	4	30	-	70	100	2	PCC
	Mandatory Audit Course –I	2	-	-	2	-	-	-	-	-	MAC
WS-261C	Workshop- III	-	-	6	6	30	-	70	100	3	SEC
	Total	20	3	14	37	240	450	210	900	28	

Note: Exams Duration will be as under
(a) Theory exams will be of 03 hours duration.
(b) Practical exams will be of 02 hours duration
(c) Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – IV) MECHANICAL ENGINEERING (2017-18)

Course No.	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
		ME-202C	Kinematics of Machines	3	-	-	3	25			
ME-204C	Material Science and Engineering	4	-	-	4	25	75	-	100	4	PCC
ME-206C	IC Engines	3	1	-	4	25	75	-	100	4	PCC
ME-208C	Fluid Machines	3	-	-	3	25	75	-	100	3	PCC
ME-210C	Manufacturing Technology and Metrology	3	-	-	3	25	75	-	100	3	PCC
ME-212C	Advanced Strength of Materials	3	1	-	4	25	75	-	100	4	PCC
ME-252C	Kinematics of Machines Lab	-	-	2	2	15	-	35	50	1	PCC
ME-254C	Material Science and Engineering Lab	-	-	2	2	15	-	35	50	1	PCC
ME-256C	IC Engines Lab	-	-	2	2	15	-	35	50	1	PCC
ME-258C	Fluid Machines Lab	-	-	2	2	15	-	35	50	1	PCC
	Mandatory Audit Course –II	2	-	-	2	-	-	-	-	-	MAC
WS-262C	Workshop- IV	-	-	6	6	30	-	70	100	3	SEC
	Total	21	2	14	37	240	450	210	900	28	

Note: Exams Duration will be as under

- (a) Theory exams will be of 03 hours duration.
- (b) Practical exams will be of 02 hours duration
- (c) Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – V) MECHANICAL ENGINEERING (2017-18)

Course No.	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
ME-301C	Dynamics of Machines	3	1	-	4	25	75	-	100	4	PCC
ME-303C	Refrigeration and Air Conditioning	3	1	-	4	25	75	-	100	4	PCC
ME-305C	Industrial Engineering	3	-	-	3	25	75	-	100	3	PCC
ME-307C	Machine Design – I	3	-	-	3	25	75	-	100	3	PCC
	Discipline Specific Elective Course-I	3	-	-	3	25	75	-	100	3	DSE
	General Elective Course- I	3	-	-	3	25	75	-	100	3	GEC
ME-351C	Dynamics of Machines Lab	-	-	2	2	15	-	35	50	1	PCC
ME-353C	Refrigeration and Air Conditioning Lab	-	-	2	2	15	-	35	50	1	PCC
WS-361C	Workshop-V	-	-	6	6	30	-	70	100	3	SEC
	Total	18	2	10	30	210	450	140	800	25	

Note: Exams duration will be as under

- (a) Theory exams will be of 03 hours duration.
- (b) Practical exams will be of 02 hours duration
- (c) Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – VI) MECHANICAL ENGINEERING (2017-18)

Course No.	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
ME-302C	Heat and Mass Transfer	3	1	-	4	25	75	-	100	4	PCC
ME-304C	Computer Aided Design	3	-	-	3	25	75	-	100	3	PCC
ME-306C	CAM and Automation	3	-	-	3	25	75	-	100	3	PCC
ME-308C	Machine Design –II	3	-	-	3	25	75	-	100	3	PCC
	Discipline Specific Elective Course-II	3	-	-	3	25	75	-	100	3	DSE
	General Elective Course- II	3	-	-	3	25	75	-	100	3	GEC
ME-352C	Heat and Mass Transfer Lab	-	-	2	2	15	-	35	50	1	PCC
ME-354C	Computer Aided Design Lab	-	-	2	2	15	-	35	50	1	PCC
ME-356C	CAM and Automation Lab	-	-	2	2	15	-	35	50	1	PCC
ME-358C	Presentation Skill Development	-	-	2	2	50	-	-	50	1	AECC
WS-362C	Workshop-VI	-	-	6	6	30	-	70	100	3	SEC
	Total	18	1	14	33	275	450	175	900	26	

Note: Exams Duration will be as under

- (a) Theory exams will be of 03 hours duration.
- (b) Practical exams will be of 02 hours duration
- (c) Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4th YEAR (SEMESTER – VII) MECHANICAL ENGINEERING (2017-18)

Credits: 10 (SEC)

S.No.	Course No.	Title	Teaching Schedule	Examination Schedule (Marks)		
				Annual Exam	Continuous Assessment	Total
1.	ME-401C	Industrial Training	6 Months(1 st week of June to 1 st week of December)	350	150	500

Procedure for Annual Exam and Continuous Assessment of Industrial Training:

(A) Annual Exams Marks

- | | |
|------------------------|-----------|
| 1. Training Evaluation | 100 Marks |
| 2. Training Seminar | 100 Marks |
| 3. Training Viva | 150 Marks |

(B) Continuous Assessment Marks

- | | |
|-------------------------------------|----------|
| 1. Assessment by University Faculty | 50 Marks |
| 2. Assessment by Industrial Guide | 50 Marks |
| 3. Conduct Marks | 50 Marks |

Total: 500 Marks

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS

B.TECH 4th YEAR (SEMESTER – VIII) MECHANICAL ENGINEERING (2017-18)

Course No.	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
ME-402C	Operations Research	3	1	-	4	25	75	-	100	4	PCC
	Discipline Specific Elective Course-III	3	-	-	3	25	75	-	100	3	DSE
	Discipline Specific Elective Course-IV	3	-	-	3	25	75	-	100	3	DSE
	Discipline Specific Elective Course-V	3	-	-	3	25	75	-	100	3	DSE
	General Elective Course- III	3	-	-	3	25	75	-	100	3	GEC
ME-452C	Project	-	-	8	8	30	-	70	100	4	SEC
WS-462C	Workshop-VII	-	-	6	6	30	-	70	100	3	SEC
	Total	15	1	14	30	185	375	140	700	23	

Note: Exams Duration will be as under

- (a) Theory exams will be of 03 hours duration.
- (b) Practical exams will be of 02 hours duration
- (c) Workshop exam will be of 03 hours duration

HAS-101C PHYSICS I
B. Tech I Semester

No. of Credits: 4	Sessional:	25 Marks
L T P Total	Theory :	75 Marks
4 0 0 4	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Physics II, Engineering Mechanics, Material Science

Course Objectives:

The objective of the course is to make the students familiar with topics of general physical optics like interference, diffraction, polarization, fiber optics, lasers. The second part of the syllabus consists of theory of relativity, electrostatics and electrodynamics.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the basics of interference and diffraction.
- CO 2-** Learning the phenomenon of polarization and have elementary knowledge of lasers and fibre optics.
- CO 3-** Know the fundamentals of Electrostatics and Electrodynamics.
- CO 4-** Comprehend the basics of special theory of relativity.

Syllabus:

UNIT I Interference: Coherent sources, conditions for sustained interference, Analytical treatment of interference, Division of Wave-Front - Fresnel's Biprism, Division of Amplitude- Interference by a plane parallel film, Wedge-shaped film, Newton's Rings, Michelson Interferometer, applications (Resolution of closely spaced spectral lines, determination of wavelengths).

Diffraction: Difference between interference and diffraction Fraunhofer and Fresnel diffraction. Fraunhofer diffraction through a single slit, Plane transmission diffraction grating, absent spectra, dispersive power, resolving power and Rayleigh criterion of resolution.

UNIT II Polarisation: Polarised and unpolarised light, Uniaxial crystals, optic axis, double refraction, Nicol prism, quarter and half wave plates, Detection and Production of different types of polarized light, Polarimetry; Optical and specific rotation, Biquartz and Laurent's half shade polarimeter.

Laser and Fibre Optics: Spontaneous and Stimulated emission, Laser principle, Einstein's coefficients, characteristics of laser beam-concept of coherence, spatial and temporal coherence, He-Ne and semiconductor lasers (simple ideas), applications.

Propagation of light in optical fibres, numerical aperture, V-number, single and multimode fibres, Elementary idea of attenuation and dispersion, applications.

UNIT III Electrostatics: Dielectric polarization, dielectric relaxation process, types of polarization, relation between E, P and D , Gauss's law in the presence of a dielectric, Energy stored in a uniform electric field, dielectric losses and variation with frequency.

Electrodynamics: Maxwell's field equations –significance, differential and integral form, Maxwell's equations in different media- free space, dielectric and conductor.

UNIT IV Special Theory of Relativity: Inertial and non-inertial frames, Galilean transformations, Michelson's Morley Experiment, Postulates of Special Theory of Relativity, Lorentz transformations, Consequences of LT (length contraction and time dilation), addition of velocities, variation of mass with velocity, mass energy equivalence.

Text Books

1. Perspectives of Modern Physics - Arthur Beiser (TMH)
2. Optics – Ajoy Ghatak (TMH)
3. Modern Physics for Engineers – S.P. Taneja (R. Chand)
4. Engineering Physics – Satya Prakash (Pragati Prakashan)
5. Modern Engineering Physics – A.S.Vasudeva (S. Chand)
6. Engineering Physics (Vol-1)- S.L. Gupta (Dhanpat Rai)

Reference Books:

1. Fundamentals of Physics – Resnick & Halliday (Asian Book)
2. Introduction to Electrodynamics – D.J. Griffith (Prentice Hall)

HAS-103C MATHEMATICS I

B. Tech I Semester

No. of Credits: 4	Sessional:	25 Marks
L T P Total	Theory :	75 Marks
4 0 0 4	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Mathematics II, Numerical Methods, Operations Research

Course Objectives:

To make students able to learn about matrices, rank, Eigen values and Eigen vectors and about the quadratic form of the matrices, Taylor's series, Macluarin's series, Asymptotes, Curvature, partial differentiation, Composite and Implicit functions, Maxima-Minima of functions of two variables, Differentiation under the integral sign, Double Integral, Triple Integral, Beta & Gamma functions, Scalar and Vector-point functions, gradient, divergence and curl of a vector, Green's theorem, Stoke's theorem, Gauss-Divergence theorem and their application.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understanding matrices, rank, eigen values and eigen vectors and about the quadratic form of the matrices.
- CO 2-** Learning about Taylor's series, Macluarin's series , Asymptotes, Curvature, Students learn about partial differentiation, Composite and Implicit functions, Maxima-Minima of functions of two variables, Differentiation under the integral sign.
- CO 3-** Explore Double integral, Triple integral, Beta & Gamma functions and their applications.
- CO 4-** Acquire knowledge about scalar and vector point function, gradient, divergence and curl ,Green's ,Divergence and Stoke's theorem and their applications.

Syllabus:

UNIT I Matrices and its Applications: Rank of Matrix, Normal form, Inverse using Gauss-Jordon method, Consistency of linear system of equations using Rank method, Linear and Orthogonal transformation, Linear-dependence and Linear-Independence of Vectors, Eigen-Values and its properties, Eigen-Vectors, Cayley-Hamilton theorem & its applications, Diagonalisation of Matrices, Similar Matrices, Quadratic Forms.

UNIT II Applications of Derivatives: Taylor's & Maclaurin's Series for one variable, Asymptotes, Curvature, Radius of Curvature for Cartesian, Parametric and Polar-curves, Radius of curvature at the Origin (by using Newton's method, by method of Expansion), Center of curvature.

Partial Differentiation and its Applications: Functions of two or more variables, Partial derivatives of 1st and higher order, Total differential and differentiability, Euler's theorem for Homogeneous functions, Derivatives of Composite and Implicit functions, Jacobians, Taylor's series for functions of two variables, Maxima-Minima of functions of two variables, Lagrange's Method of undetermined multipliers, Differentiation under the integral sign (Leibnitz rule).

UNIT III Double and Triple Integrations: Double integral, Change of Order of Integration, Double integral in Polar co-ordinates, Applications of double integral to find (i) Area enclosed by plane curves (ii) Volume of solids of revolution, Triple Integral, Change of variables, Volume of solids, Beta & Gamma functions and relation between them.

UNIT IV Vector Calculus: Differentiation of vectors, Scalar and Vector-point functions, Gradient of a scalar field and directional derivatives, Divergence and Curl of a vector field and their physical interpretations, Integration of vectors, line integral, Surface integral, Volume integral, Green's theorem, Stoke's theorem, Gauss-Divergence theorem(without proof) with their simple applications.

Text Books/ Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyzig
2. B.S. Grewal, Higher Engg. Mathematics, Khanna Publications.
3. Reena Garg, R S Goel, Deepankar Sharma, Engg. Mathematics-I, Khanna Publications.
4. Advanced Engineering Mathematics, Dr. Babu Ram, Pearsons publications.
5. Engineering Mathematics Seventh Edition by John Bird, Published by Newnes.
6. Advanced Engineering Mathematics, K.A. Stroud, Dexter Booth, Published by Palgrave.

HAS-105C CHEMISTRY
B. Tech I/II Semester

No. of Credits: 3	Sessional:	25 Marks
L T P Total	Theory :	75 Marks
3 0 0 3	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Material Science

Course Objectives:

To illustrate the basic understanding of Analytical chemistry and to improve the reasoning ability of the student towards chemistry in everyday life, enhance the basic knowledge for the theoretical aspect of engineering chemistry. To make students aware about the various applications of chemical sciences in engineering.

Course Outcomes (COs): At the end of the program the students acquired knowledge about:

- CO 1-** Illustrate the basic parameters of water, different water softening processes and effect of hard water in industries.
- CO 2-** Describe the basic properties and application of various polymers as an engineering material.
- CO 3-** Demonstrate the mechanism, physical and chemical properties of lubricants and their applications.
- CO 4-** Apply instrumental techniques of chemical analysis.

Syllabus:

UNIT I Polymers and Polymerization: Introduction & Classification of polymers. effect of structure on properties of polymers, Bio degradable polymers, preparation, properties and technical application of thermo–plastics (PVC, PE, Teflon)& thermosets (PF,UF), elastomers (SBR,BUNA-N), Silicones, Introduction to polymeric composites.

Phaserule: Terminology, Derivation of Gibb’s phase rule. One component system: water system, two components systems: Simple eutectic system (Pb – Ag), system with congruent melting point (Zn – Mg), Cooling curves.

UNIT II Water and its Treatment: Hardness of water and its determination, (EDTA method) units of hardness, alkalinity of water and its determination, Related

numerical problems, Problems associated with boiler feed water: scale and sludge formation, Priming and foaming, Boiler corrosion & Caustic embrittlement. Water softening Techniques: Lime-Soda treatment, Zeolite, Ion – exchange process, Mixed bed demineralization.

UNIT III Corrosion and its Prevention: Mechanism of Dry and wet corrosion (rusting of iron), types of corrosion, galvanic corrosion, differential aeration corrosion, stress corrosion. Factors affecting corrosion, preventive measures (proper design, Cathodic and Anodic protection, Protective coatings), Soil corrosion, Microbiological Corrosion.

Lubrication and Lubricants: Introduction, mechanism of lubrication, classification of lubricants. Additives for lubricants. Properties of lubricants (Flash & Fire point, Saponification number, Iodine value, Acid value, Viscosity and Viscosity index Aniline point, Cloud point and pour point).

UNIT IV Fuels: Definition and characteristics of a good fuel, Classification of fuels with suitable examples, Definition and determination of calorific value of a fuel with the help of bomb calorimeter, Proximate and Ultimate analysis of a fuel and its importance, Merits and demerits of gaseous fuel over other varieties of fuel, Composition properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas (iv) LPG (v) CNG.

HAS-107C ENVIRONMENTAL STUDIES
B. Tech I/II Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre –Requisite: None

Successive: None

Course Objectives:

The prime objective of the course is to provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities. The students will be able to identify the natural resources and suitable methods for their conservation and sustainable development. The focus will be on awareness of the students about the importance of ecosystem and biodiversity for maintaining ecological balance. The students will learn about various attributes of pollution management and waste management practices. The course will also describe the social issues both rural and urban environment and environmental legislation.

Course Outcomes (COs): At the end of the program the students acquired knowledge about:

- CO 1-** Understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development. The students will also be able to introduce the thinking about environmental issues from an interdisciplinary perspective.
- CO 2-** Identify and relate about the renewable and non-renewable resources, their importance and ways of conservation to sustain human life on earth.
- CO 3-** Know about the concepts of ecosystem and its function in the environment, the need for protecting the producers and consumers in various ecosystems and their role in the food web.
- CO 4-** Recognize, relate and become sensitive to the effects of pollution and will be able to contribute his learning's towards their prevention or mitigation. The students will also be able to describe the social issues along with the trends of human population growth and the possible means to combat the challenges.

Syllabus:

UNIT I The Multidisciplinary Nature of Environmental Studies:

Definition, scope and importance. Need for public awareness.

UNIT II Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems:

- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests 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 mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III Ecosystems:

- Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers.
- Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem:
a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT IV Biodiversity and its Conservation:

- Introduction – Definition: genetic, species and ecosystem diversity.

- Biogeographical 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 V Environmental Pollution: Definition.

- Causes, effects and control measures of: a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT VI Social Issues and the Environment:

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

UNIT VII Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS.

Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

UNIT VIII 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.

Text Books:

1. Perspectives in Environmental Studies by A. Kaushik and C. P. Kaushik, New age international publishers.
2. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi

Reference Books:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela . 2008 PHI Learning Pvt Ltd.
3. Environmental Science by Daniel B. Botkin& Edwards A. Keller, Wiley INDIA edition.
4. Fundamentals of Ecology by Odum, E.P., Barrick, M. and Barret, G.W.Thomson Brooks/Cole Publisher, California, 2005.

Other background readings:

1. Das, Manoj *Tales Told by Mystics*. SahityaAkademi. New Delhi 2001
2. UshaBande. *Pointed Vision: An Anthology of Short Stories*. Oxford UP. 2002
3. Reference material consisting of poems and material related to Romantic poetry to be circulated by the teacher consisting of introductory notes on French revolution and industrial revolution.

EC- 101C ELEMENTS OF ELECTRONICS ENGINEERING

B. Tech I/II Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional:

25 Marks

Theory :

75 Marks

Total :

100 Marks

Duration of Exam:

3 Hours

Pre –Requisite: None

Successive: Material Science, Mechatronics, Industrial Control

Course Objectives:

Fundamental knowledge in the field of electronics will be provided in this course by emphasizing on the basic components and circuits like the diodes, BJTs, JFETS, MOSFETS etc. Such different types of circuitry components/circuits and their applications are introduced so as to complete the theoretical and practical basis on analog circuit design.

Course Outcomes (COs): At the end of the program the students acquired knowledge about:

CO 1- Basics of digital electronics, solving problems related to number systems and Boolean algebra, various flip flops.

CO 2- The semiconductors and diodes, transistors, amplifiers and their applications.

CO 3- Display devices like LCDs, LEDs and Optoelectronic devices.

CO 4- Electronic instruments like CRO, function generator and multimeter etc.

CO 5- Basics of Communication system and modulation techniques like AM, FM, PM etc.

Syllabus:

UNIT I Semiconductor Physics: Overview of Semiconductors, PN junction diode and Zener diode –Diode circuits: rectifiers (bridge type only), filters, clippers and clampers - BJT construction, operation, characteristics (CB, CE and CC configurations) and uses – JFET and MOSFET construction, operation, characteristics (CS configuration) and uses.

UNIT II Digital Electronics: Binary, Decimal, Octal and Hexadecimal number systems and conversions, Boolean Algebra, De Morgan's theorem, logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR), Combinational and sequential circuits, Introduction to flip-flops (S-R & J-K).

UNIT III Electronics Instruments: Role, importance and applications of general-purpose test instruments like Multimeter: Digital & Analog, Cathode Ray Oscilloscope (CRO), Function/Signal Generator.

UNIT IV Optoelectronic Devices and Displays: Photoconductive cell - photovoltaic cell - solar cell – photodiodes – phototransistors, Seven segment display: Common anode and Common cathode connections and applications.

LED DISPLAY: Construction, Working, Advantages, Disadvantages and Applications.

LCD DISPLAY: Types of liquid crystals; Types of LCD display:- Dynamic scattering and field effect type; Construction, Working, Advantages, Disadvantages and Applications.

UNIT V Communication System: Block diagram of a basic communication system – frequency spectrum - need for modulation - methods of modulation - principles of AM, FM, PM , pulse analog and pulse digital modulation – AM / FM transmitters & receivers (block diagram description only)

Text / Reference Books:

1. Sedra A S and Smith K C, “Microelectronic Circuits” 4th Ed., New York, Oxford University Press, New York (1997).
2. Tocci R J and Widmer N S, “Digital Systems – Principles and Applications”, 8th Ed., Pearson Education India, New Delhi (2001).
3. Cooper and Helfrick, “Modern Electronic Instrumentation and Measuring Techniques”, 4th print Prentice Hall of India, New Delhi (1996)
4. Boylestad and Nashelsky, “Electronic Devices and Circuit Theory”, 8th Ed, Pearson Education India, New Delhi (2002).
5. Millman and Grabel, “Microelectronics”, 2nd Ed. Tata McGraw-Hill (1999).

ME-101C BASICS OF MECHANICAL ENGINEERING

B. Tech I / II Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre –Requisite: None

Successive: Thermodynamics, Mechanics of Solids, Manufacturing Processes

Course Objectives:

The main objective of teaching this course is to provide the basic knowledge of mechanical engineering.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basics of thermodynamics and I.C. Engines.

CO 2- Learn about the working of various power transmission devices and lifting machines.

CO 3- Grasp the concept of stresses and strains.

CO 4- Explore basics of manufacturing processes, operations of machine tools and measuring tools.

Syllabus:

UNIT I Basic Concepts of Thermodynamics: Macroscopic and Microscopic Approaches, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Properties – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Concept of Thermodynamic Work and Heat, Zeroth Law of Thermodynamics, Energy and First law of Thermodynamics, First law applied to non flow processes, Internal Energy and Enthalpy. Numerical Problems.

UNIT II I.C. Engines: Introduction, classification, Constructional details and working of 2 stroke & 4 stroke petrol engine & diesel engine, Otto, diesel and dual cycles, simple problems on Otto & diesel cycles.

UNIT III Simple Lifting Machines: Definition of machine, velocity ratio, Mechanical advantage, Efficiency, Laws of machines, Reversibility of machine, Wheel and axle, Differential pulley block, Single, Double and Triple start worm and worm wheel, Simple and compound screw jacks, Problems.

UNIT IV Basics of Power Transmission: Transmission of mechanical power: introduction belt drives, gear drives, their advantages and disadvantages. Introduction to brakes and clutches.

UNIT V Stresses and Strains: Introduction, Concept & types of Stresses and Strains, Poissons ratio, stresses and Strains in simple and compound bars under axial loading, Stress– Strain diagrams, Hook’s law, Elastic constants and Mechanical Properties of metals like mild steel and cast iron.

UNIT VI Basics of Manufacturing Processes and Measurements: Brief introduction to classification of different manufacturing processes: Primary shaping processes, metal cutting processes, joining processes, finishing processes and processes bringing change in properties, Working principle, parts and specification of commonly used machine tools in workshop such as Lathe, Shaper and Milling.

Measuring Instruments: introduction to slip gauges, Go and No Go gauges, dial gauges, vernier calliper, micrometer, sine bar, vernier height gauges.

Text Books:

1. Basics of Mechanical Engineering- R.K Rajput Laxmi Pub, Delhi.
2. Elements of Mechanical Engineering- D.S Kumar, S.K Kataria and Sons.
3. Engineering Thermodynamics- P.K Nag TMH, New Delhi.
4. Workshop Technology Vol I & II –Hazra & Chaudhary, Asian Book Comp., New Delhi.

Reference Books:

1. Engineering Thermodynamics- C.P Arora, Pub- TMH, New Delhi.
2. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, - East- West Press.
- 3 Manufacturing Process & Systems- Oswald, Munoz, John Wiley.
- 4 Workshop Technology Vol I, II & III- Chapman, WAJ, Edward Arnold.
5. Basics of Mechanical Engineering – Vineet Jain, Dhanpat Rai Publications
6. Automobile Engineering by Dr Kirpal Singh, standard Publishers Distributors

HAS-155C CHEMISTRY LAB
B. Tech I/II Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total : 50 Marks
Duration of Exam: 2 Hours

Pre –Requisite: Chemistry

Successive: None

Course Objectives: To apply fundamental knowledge of practical chemistry to engineering and technology.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Find out hardness of water quantitatively.

CO 2- Analyse sample of water for many parameters.

CO 3- Learn sample of lubricating oil for many parameters.

CO 4- Prepare polymeric resins in the laboratory.

List of Experiments:

1. Determination of Ca⁺⁺ and Mg⁺⁺ hardness of water using EDTA solution.
2. Determination of alkalinity of water sample.
3. Determination of dissolved oxygen (DO) in the given water sample
4. To find the eutectic point for a two component system by using method of cooling curve.
5. Determination of viscosity of lubricant by Red Wood Viscosity (No. 1 & NO. 2)
6. To determine flash point& fire point of an oil by Pensky Marten's flash point apparatus.
7. To Prepare Phenol formaldehyde and Urea formaldehyde resin.
8. To find out saponification no. of Oil
9. To determine TDS of Water samples of different sources.
10. Determination of concentration of KMnO₄ solution spectrophotomerically
11. Determination of strength of HCl solution by titrating against NaOH solution conductometrically.
12. To determine amount of sodium and potassium in a, given water sample by flame photometer.
13. Estimation of total iron in an iron alloy.

Reference Books:

1. Advanced practical organic chemistry, O P Agarwal, (Krishna publishing).
2. Advanced practical inorganic chemistry, Gurdeep Raj, (Krishna publishing).
3. Advanced practical physical chemistry, J B Yadav, (Krishna publishing).

ME-151C BASICS OF MECHANICAL ENGINEERING LAB
B. Tech I/II Semester

No. of Credits: 1	Sessional:	15 Marks
L T P Total	Practical:	35 Marks
0 0 2 2	Total :	50 Marks
	Duration of Exam:	2 Hours

Pre –Requisite: Basics of Mechanical Engineering

Successive: Thermodynamics, Mechanics of Solids, Manufacturing Processes

Course Objectives:

To understand the basics of mechanical engineering by working models and experiments.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Understand the basics of working of boilers, mountings and accessories.

CO 2- Grasp the principle and working of two strokes and four strokes internal combustion engines.

CO 3- Analyse the mechanisms of simple lifting machines.

CO 4 - Exploring the mechanism of gear drive.

CO 5- Learn use of various measuring devices.

List of Experiments:

1. To study the construction and working of Cochran and Babcock & Wilcox boilers.
2. To study the function and working of various mountings and accessories in a boiler.
3. To study the construction and working of 2 stroke & 4 stroke diesel engine.
4. To study the construction and working of 2 stroke & 4 stroke petrol engine.
5. To calculate the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
6. To calculate the mechanical advantage, velocity ratio and efficiency winch crab.
7. To study Simple screw jacks and compound screw jacks and determine their efficiency.
8. Measurement of diameter of shaft using (i) vernier caliper (ii) digital caliper (iii) vernier micrometer (iv) digital micrometer.
9. Measurement of angle of taper using sine bar.
10. To study the different types of gears.

HAS-102C PHYSICS II
B. Tech II Semester

No. of Credits: 4
L T P Total
4 0 0 4

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre –Requisite: Physics I

Successive: Engineering Mechanics, Material Science, Micro and Nano Manufacturing

Course Objectives:

This course introduces basic principles of crystal structure along with the defects. Emphasis is placed on the shortcoming of classical physics at the turn of the century leading to the discoveries of the modern era. The concepts of quantum mechanics and solid state serve as the foundation stone for the course. Extensions of these topics will include the modern view of the atom, wave particle duality of light, distribution of atoms, magnetism and conductivity. Through this course students will be able to understand the basics of Nanotechnology and Superconductivity.

Course Outcome (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the basics of crystal structure and defects in solids. They would also be able to comprehend Quantum Physics and its relevance in the modern era.
- CO 2-** Learn the fundamentals of Free electron theory and have an elementary idea of Nano science and Nanotechnology.
- CO 3-** Knowing Band theory of solids and Photoconductivity.
- CO 4-** Comprehend magnetic properties of solids and superconductivity and their applications in the contemporary world.

.Syllabus:

UNIT I Crystal Structure: Space lattice, unit cell and translation vector, Miller indices, inter-planar spacing, simple crystal structure (NaCl and Diamond), Bragg's law, Laue method, powder method, Point defects in solids – Schottky and Frenkel defects.

Quantum Physics: Difficulties with Classical physics, Introduction to quantum mechanics-simple concepts. Black Body radiation, Planck's radiation law, de-Broglie hypothesis, phase velocity and group velocity. Schrodinger wave equations-time dependent and time independent, Particle in a one-dimensional

box, Elementary idea of Quantum Statistics (Bose-Einstein and Fermi-Dirac Statistics), distribution function.

UNIT II Nanomaterials and Applications: Basic principle of Nanoscience and Nanotechnology, synthesis of nanoparticles, techniques- ball milling, sputtering, plasma synthesis, properties of nanoparticles-mechanical, optical, magnetic and electronic; introduction to carbon nanotubes.

Free Electron Theory: Elements of classical free electron theory and its limitations, Drude's theory of conduction, quantum theory of free electrons. Fermi level, density of states. Fermi-Dirac distribution function, Concept of thermionic emission-Richardson equation.

UNIT III Band Theory Of Solids: Origin of energy bands, Kronig-Penny model (qualitative), E-K diagrams, Brillouin Zones, concept of effective mass and holes. Classification of solids into metals, semiconductors and insulators, Fermi energy and its variation with temperature, Hall Effect and its applications.

Photoconductivity & Photovoltaics: Photoconductivity in insulating crystal, variation with illumination, effect of traps, application of photoconductivity, photovoltaic cells, solar cell and its characteristics.

UNIT IV Magnetic Properties of Solids: Atomic magnetic moments, orbital diamagnetism, classical theory of paramagnetism, ferromagnetism- molecular fields and domains.

Superconductivity: Introduction (Experimental survey), Meissner effect, London equations, Hard and Soft superconductors, Elements of BCS Theory, Applications of superconductors

Text Books:

1. Perspectives of Modern Physics - Arthur Beiser (TMH)
2. Optics – Ajoy Ghatak (TMH)
3. Modern Physics for Engineers – S.P.Taneja (R. Chand)
4. Engineering Physics – Satya Prakash (Pragati Prakashan)
5. Modern Engineering Physics – A.S.Vasudeva (S. Chand)
6. Engineering Physics (Vol-2)- S.L. Gupta (Dhanpat Rai)

HAS-104C MATHEMATICS II

B. Tech II Semester

No. of Credits: 4
L T P Total
4 0 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre –Requisite: Mathematics I

Successive: Numerical Methods, Operations Research

Course Objectives:

This course will give detailed view of exact differential equations, concept of obtaining suitable integrating factor, solution of ordinary differential equations with constant coefficients and variable coefficients. Application, Laplace transforms, Inverse Laplace transforms, solution of differential equations using laplace transforms, Partial Differential Equations, Lagrange’s method, Charpit’s method and Solution of homogeneous partial differential equations and application of partial differential equations to heat and wave equations, about infinite series, tests for checking convergence and divergence of infinite series. Checking the absolute convergence of alternating series.

Course Outcome (COs): At the end of the course, the student shall be able to:

- CO 1-** Acquire knowledge about many kinds of differential equations, different methods to find the solution of differential equations and applications of differential equations to solve boundary value problems and simultaneous equations.
- CO 2-** Acquire knowledge about Laplace transform, Inverse Laplace transform and its applications.
- CO 3-** knowledge about formation of partial differential equation, method to solve linear and non linear partial differential equation and method of separation of variable to solve heat and wave equation.
- CO 4-** Infinite series and different tests to check the convergence and divergence of Infinite series.

Syllabus:

UNIT I Ordinary Differential Equation and its Applications: Exact differential equation of first order, Equations reducible to exact differential equation, differential equation of second and higher order, Complete solutions of linear differential equations(Complementary Function + Particular Integral), Method of variation of parameter to find Particular Integral, Cauchy’s and Legendre’s linear Equation,

Simultaneous linear equations with constant co-efficient, Application of linear differential equations to Electric circuits(LC,LCR circuit), Newton's law of cooling, Heat flow, Orthogonal trajectory.

UNIT II Laplace-Transforms and its Applications: Laplace-transforms of elementary functions, Elementary properties of Laplace-transforms, Existence conditions, Transforms of derivatives, Transforms of Integrals, Multiplications by t^n , division by t , Evaluation of integrals by Laplace –transforms, Second shifting Theorem , Inverse transforms, Convolution theorem, Applications to linear differential equations to solve boundary value problems with constants coefficients and simultaneous linear differential equations with constant coefficients.

UNIT III Partial Differential Equation and its Application: Formation of partial-differential equations. Lagrange's linear partial –differential equations. First order non-linear partial differential equations, Charpit's method. Homogeneous Partial-differential equation of second and higher order, Method of Separation of Variables and its applications to wave equation and one dimensional Heat equation.

UNIT IV Infinite Series: Convergence and divergence of Infinite series, Comparison Test, D'Alembert's Ratio Test, Gauss Test, Integral Test, Raabe's Test, Logarithmic Test, Cauchy's Root Test, Alternating Series, Conditional Convergence & Absolute Convergence.

Text/ Reference Books:

1. B.S. Grewal – Engineering Mathematics
2. Advanced Engineering Mathematics, Erwin Kreyzig
3. Advanced Engineering Mathematics, Dr. Babu Ram, Pearsons Publications.
4. Engineering Mathematics Seventh Edition by John Bird ,Published by Newnes.
5. Advanced Engineering Mathematics, K.A. Stroud, Dexter Booth, Published by Palgrave.

HAS-109C INTERACTIVE ENGLISH

B. Tech I/ II Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre –Requisite: None

Successive: None

Course Objectives:

To read and discuss text of a chosen Shakespearean tragedy and make students familiar with Romantic poetry in English literature so as to help the students enhance their understanding of value of literature in wider socio-historical context by evoking examples from Elizabethan England, the French revolution and Industrial revolution. Thereby to furnish examples from the literary canon to be first emulated and later critiqued in creative and critical writing. At the same time, to hone the skills of students in written communication by working on the vocabulary of students so they can express themselves clearly and persuasively.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Students are conversant with representative texts of Shakespeare and Romantic poetry.

They also understand the historical context of these literary works.

CO 2- Students are able to communicate effectively in corporate environment.

CO 3- Inculcate critical thinking and demonstrate an ability to articulate their thoughts coherently and creatively.

CO 4- Command a better vocabulary and express their thoughts clearly and precisely.

.Syllabus:

UNIT I Literature: Shakespeare's Macbeth (story adaptation of play); Romantic poetry- 'The Chimney Sweeper' by Blake, 'To Autumn' by John Keats, 'The Rainbow' by William Wordsworth, 'Ozymandias' by PB Shelley, 'The Rime of the Ancient Mariner' (text of 1834) –Part-I and Part-II by Samuel Coleridge, Historical context of Romantic poetry-French Revolution and Industrial revolution.

UNIT II Functional English: Report Writing- hypothesis-evidence-thesis, Proposals/Feasibility and Progress Reports/Memo/Letter formats; Essays/paragraphs; applications; description of objects, appliances, instruments, products, processes.

UNIT III Critical thinking and Creative Writing: Critical thinking; creative writing exercises; Seven Cs of writing/ Story composition/news reports/ feature writing/verse composition, Paraphrasing poems, comprehending Unseen Passages, writing biographies, art of interviewing, book reviews.

UNIT IV Semantics and Syntax: Antonyms, synonyms, homophones, words often confused, one word substitutes, word origins, sentence correction/error correction exercises in basic grammar.

References:

1. Shakespeare Readers. Volume I. *Macbeth*. Scholastic India, 2016.
2. Michael Neill, David Schalkwyk. *The Oxford Handbook of Shakespearean Tragedy*. Oxford UP. 2016
3. Claire McEachern. *The Cambridge Companion to Shakespearean Tragedy*. Cambridge UP. 2013
4. RC Sharma and Krishna Mohan. 4th edition. *Business Correspondence and Report Writing*. McGraw Hill.
5. Bretag, Crossman, and Bordia. *Communicative Skills*. Tata McGraw Hill. 2012
6. A.C. Bradley and John Bayley. *Shakespearean Tragedy*. Penguin Books. 1991

Other Background Readings:

1. Das, Manoj *Tales Told by Mystics*. Sahitya Akademi. New Delhi 2001
2. Usha Bande. *Pointed Vision: An Anthology of Short Stories*. Oxford UP. 2002
3. Reference material consisting of poems and material related to Romantic poetry to be circulated by the teacher consisting of introductory notes on French revolution and industrial revolution.

EE-101C BASIC ELECTRICAL ENGINEERING

B. Tech I / II Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional:

25 Marks

Theory:

75 Marks

Total :

100 Marks

Duration of Exam:

3 Hours

Pre –Requisite: None

Successive: Power Plant Engineering

Course Objectives:

- To impart the basic knowledge about the DC circuits and various Network Theorems.
- To inculcate the understanding about the single phase A.C circuits and Poly phase system.
- To understand the working of various Electrical Machines.
- To introduce the basic knowledge of various source of electrical power.

Course Outcome (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand and solve the problems of DC Circuit and Network theorems.
- CO 2-** Solve problems related to single phase and three phase AC circuits.
- CO 3-** Explain the working principle, construction and applications of Electrical machines.
- CO 4-** Working of various power plants (thermal, hydro electric, gas, wind, solar etc.)

Syllabus:

UNIT I DC Circuits: Introduction of electric circuit, ohm's law, limitations of ohm's law, ideal, Practical and dependent sources and their characteristics, Source transformation, Voltage and Current division, Kirchhoff's Voltage law and Kirchhoff's Current law; Mesh and Nodal analysis, star-delta transformation.

UNIT II AC Fundamental: Production of alternating voltage or current, phasor representation of alternating quantity, instantaneous, Peak, Average and RMS values of periodic waveforms; Peak factor, Form factor; pure R,L & C in AC circuit, j notation and concept of phasor, active, reactive and apparent power, Power factor, AC series circuit RL, RC, and RLC, AC parallel circuits, combination of series and parallel circuits, Series and Parallel resonance, selectivity, bandwidth and Q factor, Earthing.

UNIT III Network Theorems: Superposition, Thevenin's and Norton's, Reciprocity, Compensation, Maximum Power transfer, Tellegan's and Millman's theorems, Application of theorems to dc and ac circuits.

UNIT IV Polyphase Systems: Advantages of 3-phase systems, generation of 3-phase voltages; phase sequence; star & delta connections; interconnection of 3-phase sources and loads; voltage, current & power in star & delta connected systems, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method, effect of power factor on wattmeter reading.

UNIT V Electrical Machines: Introduction to transformer, DC machines, induction motor, synchronous machines; Principle, construction and working.

UNIT VI Sources of Electrical Power: Introduction to wind, solar, fuel cell, tidal, hydro electric, thermal, diesel, gas, nuclear power plants.

Text Books:

1. Basic Electrical Engineering by Kothari & Nagrath, TMH
2. Principles of Electrical Engineering by V. Del Toro, Prentice Hall
3. Electrical Technology by B L Thareja, S.Chand

CE-101C FUNDAMENTALS OF COMPUTER AND PROGRAMMING WITH C
B.Tech I/II Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre-Requisite: None

Successive: Kinematics of Machines and Operations Research

Course Objectives:

1. Learn major components of computer system, programming languages and networking concepts.
2. Understand the basic building blocks of C language like variables, data types, managing I/O etc.
3. Knowing the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays, structures etc.
4. Concept of Pointers and understand functions and file handling.

Course Outcomes (COs): After the successful completion of the course, student is able to:

CO 1- Learn the major components of computer system, programming language and Networking.

CO 2- Understand the building blocks of C language like variables, data types, managing I/O etc.

CO 3- Understand the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays and structures.

CO 4- Learn about the concept of Pointers and understand functions and file handling.

Syllabus:

UNIT I An Overview of Computer System and Operating Systems: Fundamentals: Hardware organization of a computer, CPU, Input/ Output Devices, Memories, Registers, Ports.

Different Number Systems:- Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System, and their inter-conversions.

Operating System Basics: Introduction to Operating system, Functions of an Operating Systems, Classification of Operating Systems.

UNIT II Basic Introduction to Programming Languages: Machine Language, Assembly Languages, High level Languages, Types of high level languages, Compiler, Interpreter, Assembler, Loader, Linker, Relationship between Compiler, Loader and Linker. Flowcharts.

UNIT III Basic Introduction to Computer Networks: LAN, MAN, WAN, OSI Reference model, Introduction to Internet and protocols: TCP/IP ref. model, Network connecting devices. Hypertext documents, HTTP, DNS, Network Security.

UNIT IV An Overview of C: Basic and Derived Data Types: Constants, Variables and Data types, operators and Expressions, managing I/O operations, Decision Making, branching and looping, Derived Data Types like Arrays, Strings. Structure and Union in C: Defining structure, declaring variables, Accessing structure members, structure initialization, copying and comparing structures variables, operations on individual members, Array of structure, structure with structure, unions.

UNIT V Pointers in C: Introduction, Understanding Pointers, Accessing the address of a variable, Declaring Pointer Variables, Initialization of Pointer Variables, Pointer Expressions, Pointer Increments and Scale Factors, pointers and Arrays, Pointer and Character Strings, Pointers as Function Arguments, Pointers to Functions.

UNIT VI File Management in C: Defining and opening file, closing file, I/O operation on files, error handling during I/O operations.

Text Books:

1. Fundamental of Information Technology by A.Leon &M.Leon.
2. Let Us C by Yashwant Kanetkar.
3. Fundamentals of Computers and Programming with C by A. K. Sharma Dhanpat Rai publications.

Reference Books:

1. Programming in C by Schaum Series.
2. Computer Networks (4th Edition) by Andrew S. Tanenbaum
3. Digital Principles and Application by Donald Peach, Albert Paul Malvino
4. Operating System Concepts, (6th Edition) by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne.

ME-152C PHYSICS LAB II
B. Tech II Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total : 50 Marks
Duration of Exam: 2 Hours

Pre –Requisite: Physics I

Successive: None

Course Objectives:

To develop the domain knowledge in the fields of physics and to extend knowledge and processes used by physics have produced new and exciting technologies that are in everyday use.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- To demonstrate competency and understanding of the basic concepts found in core physics courses mechanics, quantum mechanics, magnetic properties, photoconductivity and modern physics.

CO 2- To utilize the scientific method for formal investigation and to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.

List of Experiments:

1. To find the low resistance by Carey - Foster's bridge.
2. To find the resistance of a galvanometer by Thomson's constant deflection method using a post office box.
3. To find the value of high resistances by Substitution method.
4. To find the value of high resistances by Leakage method.
5. To study the characteristics of a solar cell and to find the fill factor.
6. To find the value of e/m for electrons by Helical method.
7. To find the ionisation potential of Argon/Mercury using a thyratron tube.
8. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
9. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
10. To find the value of Planck's constant by using a photo electric cell.
11. To find the value of coefficient of self-inductance by using a Rayleigh bridge.
12. To find the value of Hall Co-efficient of semi-conductor.

13. To study the V-I characteristics of a p-n diode.
14. To find the band gap of intrinsic semi-conductor using four probe method.
15. To calculate the hysteresis loss by tracing a B-H curve.

Text/ Reference Books:

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta&V.Kumar (PragatiPrakashan).
3. Advanced Practical Physics Vol.I& II – Chauhan & Singh (PragatiPrakashan).

**CE-151C FUNDAMENTALS OF COMPUTER AND PROGRAMMING WITH C
LAB
B. Tech I/II Semester**

No. of Credits: 1	Sessional:	15 Marks
L T P Total	Practical:	35 Marks
0 0 2 2	Total :	50 Marks
	Duration of Exam:	2 Hours

Pre –Requisite: FOCP

Successive: Kinematics of Machines, Operations Research

Course Objectives:

1. To understand the basic building blocks of C language like variables, data types, managing I/O etc.
2. To understand the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays, structures etc.
3. To learn about the concept of Pointers and understand functions and file handling.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Implement the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays and structures.

CO 2- Learn the concept of Pointers and understand functions, file handling.

List of Experiments:

1. Write a Program to calculate sum of two numbers
2. Write a Program to calculate Simple Interest.
3. Write a Program to find larger among two numbers
4. Write a Program to find largest among three numbers
5. Write a Program to calculate roots of a quadratic equation
6. Write a Program to print 1 to 10 using loop
7. Write a Program to print even numbers from 2 to 100
8. Write a Program to print sum of digits of a number
9. Write a Program to print the reverse of a number entered by user

10. Write a Program to print table of a number
11. Write a Program to print the Fibonacci series
12. Write a Program to calculate factorial of a number
13. Write a Program to find a^b
14. Write a Program to check if number is Prime
15. Write a Print first n terms of Fibonacci Series
16. Write a Program to find largest and smallest element in an array
17. Write a Program to find sum of two 2-D arrays
18. Write a Program to multiply two 2-D arrays
19. Write a Program to use inbuilt string functions.
20. Write a Program to check whether entered string is palindrome
21. Write a Program to calculate factorial of a number using functions
22. Write a Program to find factorial using recursion
23. Write a Program to find length of a string using pointers
24. Write a Program to calculate marks using array of structures.
25. Write a Program to copy the contents of one file to another file

Reference Books:

1. Let Us C by Yashwant Kanetkar
2. Fundamentals of Computers and Programming with C by A. K. Sharma
Dhanpat Rai publications
3. Test your C Skills by Yashwant Kanetkar

EE-151C BASIC ELECTRICAL ENGINEERING LAB

B. Tech I/II Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total : 50 Marks
Duration of Exam: 2 Hours

Pre –Requisite: Basic Electrical Engineering

Successive: None

List of Experiments:

1. To verify KCL and KVL.
2. To verify Thevenin's & Norton's theorems.
3. To verify maximum power transfer theorem.
4. To verify Superposition theorems.
5. To study frequency response of a series R-L-C circuit and determine resonant frequency & Q- factor for various Values of R, L, C.
6. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q -Factor for various values of R, L, C.
7. To find inductance of coil without core and with iron core.
8. To perform polarity test on single phase transformer.
9. To perform O.C. and S.C. test on single phase transformer.
10. To study various type of electrical instruments
11. To measurement of power and power factor in a three phase system by two wattmeter method.

HAS-159C LANGUAGE LAB
B. Tech I/II Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total : 50 Marks
Duration of Exam: 2 Hours

Pre –Requisite: Interactive English

Successive: None

Course Objectives:

To guide the students to improve their conversational and linguistic skills including better command over spoken English. Introduce students to various scenarios to help them opt for appropriate responses on interpersonal level.

Course Outcomes (COs): The students will be trained to respond better to new scenarios that demand good communication skills.

1. The students will be able to resolve potential conflicts by avoiding communication gaps and overcoming barriers.
2. Students will learn to use skills effectively for enhancing performance and even improving upon their power to persuade.

Corporate Interaction & Communication

1. Presentations
2. Listening Skills & Language Lab (Practical) Interviews of Isaac Asimov, Richard Feynman, Steve Jobs and other scientists and technocrats. Other inspiring speeches on social issues as well as related to the corporate world and industry; Audio/Video Lessons and Observation
3. Group Discussions, Corporate Dialogue: Conflict-Resolution exercises; Role Play; Mock-interviews.
4. Internal Assessment: based on participation, short presentation & performance in interactive exercises: competence gauged through participation in various events organized in the classroom and at university level throughout the semester.

Recommended:

1. Language Lab Software

ME-152C ENGINEERING DRAWING

B. Tech I/II Semester

No. of Credits: 2

L	T	P	Total
0	0	4	4

Sessional: 30 Marks

Practical: 70 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

Pre-Requisite: None

Successive: Machine Drawing, Computer Aided Design

Course Objectives:

To understand the basic principles of engineering drawing and graphics and to apply the same to draw different types of projections.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basic principles of projections of points and lines.

CO 2- Know the different orientations and projections of planes.

CO 3 – Learn projections and sectioning of solids in different orientations.

CO 4- Grasp the concepts of development of surfaces.

CO 5- Draw orthographic and isometric view of an object.

Syllabus:

UNIT I Introduction and Projections of Points: Importance and scope of Engineering Drawing, Instruments, Lettering, Types of lines, Dimensioning, Different methods of projections, B.I.S Specifications, Introduction to AutoCAD.
Introduction to plane of projection, reference & auxiliary planes, projection of points in different quadrants.

UNIT II Projection of Lines: Projection of lines parallel to reference planes, perpendicular to reference planes, inclined to one reference plane and parallel to the other, inclined to both the reference planes, traces, true inclinations & true lengths of the lines.

UNIT III Projection of Planes: Parallel to one reference plane, inclined to one plane but perpendicular to the other, inclined to both reference planes.

UNIT IV Projections and Sectioning of Solids : Projection of Polyhedra, solids of revolution-in simple positions with axis perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other. Projection of section of prisms, pyramids, cylinders and cones with axis perpendicular to one reference plane and parallel to the other reference plane.

UNIT V Development of Surfaces: Development of simple object with and without sectioning.

UNIT VI Orthographic and Isometric Projections: Orthographic projections of simple machines components and Nuts, Bolted Joints, Screw threads. Introduction to isometric projections, Isometric scale, Isometric projections/ views of plane figures like prisms, pyramids, cylinders and cones.

Text Books:

1. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.
2. A Text Book of Machine Drawing - P S Gill Pub.: S K Kataria & Sons.
3. Engineering Graphics and Machine Drawing – M. L. Aggarwal and Sandhya Dixit, Dhanpat Rai & Company.
4. Engineering Graphics with Auto CAD 2002 - James D. Bethune, Pearson Education.
5. A Text Book of Machine Drawing by Laxmi Narayana and Mathur, M/s. Jain Brothers, New Delhi.
6. Machine Drawing by N. Sidheshwar, Kannaieh, V S Sastry, TMH., New Delhi.
7. Fundamentals of Engineering Drawing by Luzadder: PHI.
8. Fundamentals of Engineering Drawing by French and Vierk; Mc Graw Hill.

WS- 161C/ WS- 162C WORK SHOP-1/II
B. Tech I/ II- Semester

No. of Credits: 3
L T P Total
0 0 6 6

Internal: 30 Marks
External: 70 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

MECHANICAL WORKSHOP (Group –I)

Course Outcomes (COs): After studying this course the students would:

- CO 1-** Have exposure to mechanical workshop layout and safety aspects.
- CO 2-** Understand the functions of various machines and cutting tools used in machine shop.
- CO 3-** Practice real time job preparation using various operations related to machine shop such as filing, drilling, milling & turning.
- CO 4 -** Practice job preparation in welding shop.
- CO 5 -** Learn to use different measuring tools like vernier caliper, vernier height gauge and micrometer.
- CO 6 -** Practice job preparation in sheet metal shop.

List of Exercises:

Fitting, sheet metal and welding workshop:

1. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
2. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.
3. To determine the least count of vernier calliper, vernier height gauge, micrometer and take different reading over given metallic pieces using these instruments.
4. To study and demonstrate the parts, specifications & operations performed on lathe machine.
5. To study and demonstrate the parts, specifications & operations performed on milling machine.
6. To study and demonstrate the parts, specifications & operations performed on shaper machine.
7. To prepare a job involving different type of filing practice exercise in specified dimensions.

8. To prepare a job involving multi operational exercise (drilling, counter sinking, tapping, reaming, hack sawing etc.)
9. To prepare a multi operational sheet metal job (self secured single groove joint/ hasp & stay etc.).
10. To practice striking an arc, straight short bead, straight continuous bead and re-start of electrode in flat position by arc welding on given M.S. plate as per size.
11. To practice tack weld of two close plate in flat position by arc welding on given M.S. plate as per size.
12. To practice close butt joint in flat position by arc welding on given M.S. plate as per size.

NOTE: - At least nine exercises should be performed from the above list; remaining three may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.

WS- 161C/ WS- 162C WORKSHOP- I/II

B.Tech I/II Semester

No. of Credits: 3

L T P Total

0 0 6 6

Internal: 30 Marks

External: 70 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

(Group –II)

PART-A

Computer Engineering Workshop

Course Outcomes (COs): After the completion of the course the student will be able to:

- CO1-** Acquire skills in basic engineering practice.
- CO2-** Have working knowledge of various equipments used in workshop.
- CO3-** Have hands on experience about various machines and their components.
- CO4-** Obtain practical skills of basic operation and working of tools used in the workshop.

1. To study and demonstrate Block diagram of Digital Computer System and brief explanation of each unit.
2. To demonstrate History/ Generation/ classifications and different types of Personnel Computer.
3. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
4. To study and demonstrate primary memory and secondary memory.
5. To demonstrate CPU Block diagram and other Peripheral chips, Mother Board/ Main Board and its parts, Connectors, Add On Card Slots etc.
6. To study working of various types of monitors: CRT type, LCD type & LED type.
7. To study Keyboard and Mouse: Wired, Wireless, Scroll & Optical with detail working.
8. To study Printers: Dot Matrix Printers, Daisy wheel Printers, Ink-Jet Printers and Laser Jet Printers with detailed working explanation.
9. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in

Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss.

10. To demonstrate networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.

PART-B

Electrical Workshop

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i.e Electric Iron , Electric Toaster , Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076” or 40/0.0076” cable.

PART- C
Electronics Workshop

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate Multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.
4. To study and demonstrate V_p (peak voltage), V_{pp} (peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.
6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and waveform observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

ME-201C MECHANICS OF SOLIDS

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre-Requisite: Basics of Mechanical Engineering, Elementary Engineering Mechanics

Successive: Advance Strength of Materials, Machine Design

Course Objectives:

To study concept of stress and strain induced in material. To study the concept of stresses in beams, columns and struts. To study shear force, bending moment in cantilever and beams and torsion in circular shaft.

Course Outcomes (COs): After studying this course, students will be able:

- CO 1-** Evaluate the strength of various structural elements internal forces such as compression, tension, shear, bending and torsion and compound stresses.
- CO 2-** Understand the basic concept of analysis and design of members subjected to torsion and bending.
- CO 3-** Analyse crushing and buckling of structural elements such as columns and struts and predict the failure by using theories of failures.
- CO 4-** Analyse the effect of shearing force and bending moments under various loading condition.

Syllabus:

UNIT I Simple Stresses & Strains: Concept & types of Stresses and Strains, Poisson's ratio, stresses and strains in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stresses & strains in simple & compound bars under axial loading, principle stresses and principal- planes, Mohr's circle of stresses. Problems.

UNIT II Shear Force & Bending Moment: Definitions, SF & BM diagrams for cantilevers, simply supported beams (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads. Problems.

UNIT III Torsion in Circular Shaft: Introduction, pure torsion, assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion. Problems.

UNIT IV Bending & Shear Stresses in Beams: Bending stresses in beams with derivation & application to beams of circular, rectangular, I and T sections, composite beams, shear stresses in beams with combined bending, torsion & axial loading of beams, Deflection of beams- moment area method, double integration method. Problems.

UNIT V Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections. Problems.

UNIT VI Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional and 3 dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading. Problems.

Text Books:

1. Strength of Materials – G.H.Ryder - Macmillan, India
2. Strength of Materials– Andrew Pytel and FredinandL.Singer, Addison – Wesley
3. Strength of Material- Sadhu Singh- Khanna Publishers

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials: A Rudimentary Approach – M.A. Jayaram, Sapna Book House, Bangalore.
3. Mechanics of solids--- Bear and Johnston, McGraw-Hill Companies.

Web Links:

<http://nptel.ac.in/courses/112107147/4>

<http://freevideolectures.com/Course/2361/Strength-of-Materials>

ME-203C FLUID MECHANICS

B.Tech (Mechanical Engineering) III Semester

No. of Credits: 4	Sessional	: 25 Marks
L T P Total	Theory	: 75 Marks
3 1 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Pre-Requisite: None

Successive: Fluid Machines, Heat and Mass Transfer

Course Objectives:

To learn the various fluid properties; concept of continuity equation and Bernoulli's; concept of laminar and turbulent flow; various losses through pipes.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Expedite the properties of fluid along with pressure measurement techniques and concept of stability.

CO 2- Understand the characteristics of fluid and application of continuity and Bernoulli's equation.

CO 3- Conceptualisation of boundary layer, laminar and turbulent flow.

CO 4- Analyse flows through pipes and open channels.

Syllabus:

UNIT I Introduction and Fluid Statics: Fluid and flow definitions and types; Properties of fluids; Continuum; Pascal's Law; Hydrostatic Law; Forces on plane and curved surfaces; stability of floating and submerged bodies; Determination of metacentric height.

UNIT II Fluid Kinematics: Lagrangian & Eulerian approach; Classification of fluid flows; Flow lines; Continuity equation; Stream function; Potential function; Rotational flow, Circulation and Vorticity; Flow Nets.

UNIT III Fluid Dynamics: Concept of system and control volume; Navier Stokes's equation; Euler's equation; Bernoulli's equation; Venturimeter, Orificemeter, Rotameter, Notches and Pitot tube; Force Momentum Equation.

UNIT IV Laminar and Turbulent Flow: Reynold's experiments; Laminar Flow between two stationary parallel plates; Hagen- Poiseuille law; Prandtl mixing length hypothesis; Velocity distribution in pipes; Concept of smooth and rough pipes; Pipe friction factor relations.

Boundary layer concept; Von-Karman momentum integral equation; Laminar and Turbulent boundary layer flows; Drag on a flat plate; Boundary layer separation and control.

UNIT V Flow in Pipes: Major and Minor Losses in pipe; Total and Hydraulic gradient line; Pipes in series and parallel; Concept of equivalent pipe; Power transmission through pipes.

UNIT VI Flow in Open Channels: Classification of open channels; Flow analysis; Empirical relations; Economical sections for maximum discharge; Most economical channels i.e. rectangular, trapezoidal and circular; Hydraulic Jump.

Text Books:

1. Fluid Mechanics – Streeter V L and Wylie E B; McGraw Hill
2. Mechanics of Fluids – I H Shames; McGraw Hill

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar; S.K. Kataria and Sons, New Delhi.
2. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas; TMH Publications, New Delhi.
3. Fluid Mechanics and Machinery – S.K. Agarwal; TMH; New Delhi.
- 4 Fluid Mechanics by Frank M. White; McGraw Hill.

ME-205C ENGINEERING MECHANICS

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 4	Sessional	: 25 Marks
L T P Total	Theory	: 75Marks
3 1 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Pre-Requisite: Physics

Successive: Kinematics of Machines, Dynamics of Machines, Mechanics of Solids

Course Objectives:

To study the various concepts of particle kinematics, analysis of basic force system. To study about particle dynamics, general equation of equilibrium, energy methods & momentum methods.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the basic force system.
- CO 2-** Apply principles of particle kinematics.
- CO 3-** Grasp the concepts of particle dynamics.
- CO 4-** Learn energy methods & momentum methods.

Syllabus:

UNIT I Review of Basic Force Systems: Dimensions and units of mechanics, idealization of mechanics, laws of mechanics, vector algebra review, moment of a force about a point and axis, the couple and couple moment, addition and subtraction of couples, moment of a couple about a line, resultant of a force system, Problems (vector method).

UNIT II Equilibrium: Introduction, free body diagram, control volumes, general equations of equilibrium, two point equivalent loading, static in-determinacy, simple truss, method of joints, method of sections, co-planer cable-loading a function of x , coplanar cables- loading the weight of the cable itself. Problems.

UNIT III Properties of Surfaces & Moments and Products of inertia : First moment of an area and the centroid, principal axes, formal definition of inertia quantities, relation between mass-inertia terms and area-inertia terms, translation of coordinate axes, transportation properties of the inertia

terms, a brief introduction to tensors, the inertia of ellipsoid and principal moments of inertia, Problems (vector method).

UNIT IV Kinematics of Particles and Rigid Bodies: Velocity and acceleration in path and cylindrical coordinates, motion of a particle relative to a pair of translating axes, translation and rotation of rigid bodies, Chasles theorem, moving references, velocity and acceleration for different references. Problems (vector method).

UNIT V Particle Dynamics, Energy Methods & Momentum Methods: Newton's law for rectangular coordinates & cylindrical coordinates, rectifier translation, central force motion, Newton's law for path variables, work energy equations, work energy equations for a systems of particles. Problems (vector method).

UNIT VI Variational Mechanics: Hamiton principle, Lagrange equations, principle of virtual work.

Text Books:

1. Engineering Mechanics - Statics & Dynamics by I.H. Shames, PHI, New Delhi.
2. Engineering Mechanics – Timoschenko.

Reference Books:

1. Statics & Dynamics by J.L. Meriam, John Wiley & Sons (P) Ltd. New York.
2. Statics & Dynamics by Beer & Johnson, MGH, New Delhi.
3. Engineering Mechanics - Statics & Dynamics by D.S.Kumar, S.K.Kataria & Sons, New Delhi.

ME-207C THERMODYNAMICS

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 4	Sessional	: 25 Marks
L T P Total	Theory	: 75 Marks
3 1 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Pre- Requisite: Basics of Mechanical Engineering

Successive: Heat and Mass Transfer, IC Engines, Refrigeration and Air Conditioning

Course Objectives:

The objective of studying this course is to understand and apply the concepts of thermodynamic properties and their relationships, laws of thermodynamics and thermodynamic behavior of pure substances to solve engineering problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO1-** Understand the basic concepts of thermodynamics and apply zeroth and first law to analyse thermodynamic processes.
- CO2-** Comprehend the second law of thermodynamics and apply it solve the problems related to heat engines, refrigerators, heat pumps compressors and nozzles etc.
- CO3-** Learn and apply the concept of entropy, availability and irreversibility to thermodynamic processes.
- CO4-** Evaluate properties of pure substances, gases and their mixtures and to derive and apply property relations to thermodynamic problems.

Syllabus:

UNIT I Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V, P-T and P-V-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam. Problems.

UNIT II Basic Concepts and First Law: Introduction, Quasi-static, Reversible and Irreversible Processes, Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility. Energy and its Forms,

Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, PMMFK, Steady flow energy equation, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Problems.

UNIT III Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir, Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin-Planck and Clausius Statements and their Equivalence, PMMSK. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot Theorem and its Corollaries, Thermodynamic Temperature Scale. Entropy, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics. Problems.

UNIT IV Availability and Irreversibility: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Dead state of a system, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility, Concept of Exergy, Exergic Efficiency and Exergy destruction. Problems.

UNIT V Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avogadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas. Vander Waal's Equation of state, Reduced Co-ordinates, Compressibility factor and law of corresponding states. Mixture of Gases, Mass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and Specific Heats, Entropy for a mixture of non-reactive gases. Problems.

UNIT VI Thermodynamic Relations: Maxwell Relations, Clapeyron Equation, Relations for changes in Enthalpy and Internal Energy & Entropy, Specific Heat Capacity Relations, Joule Thomson coefficient & inversion curve.

Text Books:

1. Engineering Thermodynamics – P K Nag, Tata McGraw Hill
2. Thermodynamics: An Engineering Approach - Cengel and Boles, McGraw Hill Company.

Reference Books:

1. Fundamentals of Engineering Thermodynamics – E. Radhakrishnan, PHI, New Delhi.
2. Engineering Thermodynamics – Jones and Dugan, PHI, New Delhi.

3. Theory and Problems of Thermodynamics – Y. V.C. Rao, Wiley Eastern Ltd., New Delhi.
4. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
5. Engineering Thermodynamics: Principles and Practices by D.S.Kumar, S.K.Kataria and Sons, New Delhi.

Web Links:

NPTEL Video Lecture ,Web: <http://nptel.ac.in>

ME-209C MANUFACTURING PROCESSES

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam. : 3Hours

Pre-Requisite: Basics of Mechanical Engineering

Successive: Manufacturing Technology and Metrology, Advanced Manufacturing Processes, Welding Technology

Course Objectives:

The main objective of teaching this subject is to disseminate the knowledge of different types of processes used in manufacturing industries.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Demonstrate the knowledge about different sand moulding and metal casting processes.

CO 2- Understand the plastic deformation of metals under rolling, extrusion, forging and sheet metal working.

CO 3- Acquire knowledge about basic welding processes and their selection for fabrication of different components.

CO 4 - Learn about different gear manufacturing and gear finishing operations.

CO 5- Acquire the basics of powder metallurgy.

Syllabus:

UNIT I Metal Casting Processes: Advantages and limitations, sand mold making procedure. Patterns: Pattern materials, pattern allowances, types of pattern, color coding. Molding materials: Molding sand composition, sand preparation, Sand molding processes. Cores: Types of cores, core prints, chaplets, and chills. Gating systems: Gates and risers. Melting practice: Cupola furnace, Defects in castings and their remedies, Precision Investment Casting, Centrifugal Casting, Continuous Casting.

UNIT II Metal Forming Processes: Nature of plastic deformation, hot working and cold working .Principles of rolling, roll passes, roll pass sequences. Forging: Forging operations, smith forging, drop forging, press forging, forging defects.

UNIT III Extrusion and Sheet Metal Operations: Extrusion principle, hot extrusion, cold extrusion, wire drawing, swaging, tube making. Sheet metal operations: Press tools operations, shearing action, drawing dies, spinning, bending, stretch forming, embossing and coining.

UNIT IV Welding Process: Principles of welding, brazing and soldering, Classification of Welding Processes, gas welding and cutting process, equipment. Arc welding power source and consumables. Resistance welding: Principle and equipments, resistance spot welding, resistance seam welding, electro slag welding, forge welding.

UNIT V Advance Welding Processes: Tungsten inert gas welding (TIG), metal inert gas welding (MIG), MMAW, electron beam welding, friction welding, and diffusion welding: their working principle, equipments, parameters and applications.

UNIT VI Powder Metallurgy: Powder manufacturing, compaction and sintering processes. Advantages and applications of Powder Metallurgy.

Text Books:

1. Principles of Manufacturing Materials & Processes – Campbell J. S., Publisher – Mc Graw Hill.
2. Manufacturing Science - Ghosh A; Mallik A.K. Affiliated East-West Press Pvt. Ltd., New Delhi
3. Manufacturing Processes- H S Shan, Cambridge University Press 2nd Edition 2017.
4. Production Technology – P C Sharma –S.Chand publications, New Delhi.

Reference Books:

1. Foundry Technology - K.P. Sinha, D.B. Goel, Roorkee Publishing House.
2. Welding and Welding Technology - Richard L. Little Tata McGraw Hill Ltd.
3. Manufacturing Processes and Systems: Ostwald Phillip F., Munoz Jairo, John Wiley & Sons
4. Manufacturing Technology-Foundry, Forming and Welding - P.N. Rao, Tata McGraw Hill, New Delhi.
5. Elements of Manufacturing Processes – B.S. Nagendra Parasher, RK Mittal, PHI N. Delhi

6. NPTEL Video Lecture ,Web: <http://nptel.ac.in>

ME-211C NUMERICAL METHODS

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Mathematics

Successive: Operations Research

Course Objectives:

To study essential concepts of different numerical methods. To study concept and interfacing of Errors and accuracy. To study numerical solution of ordinary differential equations and partial differential equations.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1 – Analyses of Numerical solution of partial differential equations.

CO 2 – Solution to the linear simultaneous equations.

CO 3 – Expedite Numerical solution of ordinary differential equations.

CO 4 – Conceptualizations of optimization.

Syllabus:

UNIT I Numerical solution of algebraic and transcendental equations: Bisection method, newton's method of false position, secant method, newton raphson method, iteration method.

UNIT II Solution of linear simultaneous equations: Gauss elimination method, gauss jordon method, jacobi's iteration method, gauss siedal iteration method.

UNIT III Finite differences: Difference operators and relations between them, newton's forward and backward interpolation formulae, central difference interpolation formulae by stirling and bessel, lagranges and newton divided, difference formulae for unequal intervals, curve fitting, least square method.

UNIT IV Numerical differentiation and integration: Differentiation formulae derived from interpolation formulae, newton cote's quadrature formulae, trapezoidal rule, simpson's 1/3 and 3/8 rules, booles rules, weddles rule, gaussian quadrature formulae.

UNIT V Numerical solution of ordinary differential equations: Taylor series method, picard's method, euler's method, modified euler's method, runge's method, runge kutta's method, predictor –corrector methods by milne and adam bash forth.

UNIT VI Numerical solutions of partial differential equation's: Finite difference approximation of partial derivatives, solution of laplace equations by standard 5 point formula, solution of one dimensional heat flow equations by crank nicolson method.

Text Books:

1. Numerical method in Engg. and science by B S Grewal (Khanna publishers)
2. Numerical method by Jain, Iyeger (Wiley Eastern Ltd)

Reference Books:

1. Numerical method for mathematics, science & engg by John Mathews (Prentice Hall of India, New Delhi) .
2. Introduction & methods of numerical analysis by S D Sastry (Prentice Hall of India, New Delhi)

ME-251C MECHANICS OF SOLIDS LAB

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total : 50 Marks
Duration of Exam: 02 Hours

Pre- Requisite: Mechanics of Solids

Successive: Machine Design

Course Objectives:

The objective of the Mechanics of Solid lab is to demonstrate the basic principles in the area of strength and mechanics of materials and structural analysis to the undergraduate students through a series of experiments. In this lab the experiments are performed to measure the properties of the materials such as impact strength, tensile strength, compressive strength, hardness, ductility etc.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Learn the principles of mechanics of solid and engineering.

CO 2- Preparation of formal laboratory reports describing the results of experiments.

CO 3- Acquire to operate basic instruments in mechanics of materials lab.

CO 4- Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.

List of Experiments:

1. To perform the Brinell hardness test.
2. To perform the Rockwell hardness test.
3. To perform the Vickers hardness test on Universal Hardness Tester.
4. To study the Erricson sheet metal testing machine & perform the Erricson sheet metal test.
5. To perform the Impact tests (Izod&Charpy) on Impact Testing Machine.
6. To perform the tensile test on Universal Testing Machine.
7. To perform compression & bending tests on UTM.
8. To perform the shear test on UTM.
9. To perform the torsion test on a Torsion Testing Machine.
10. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under Point and Distributed Loads.

ME-253C FLUID MECHANICS LAB

B. Tech (Mechanical Engineering) III Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total : 50 Marks
Duration of Exam: 02 Hours

Pre- Requisite: Fluid Mechanics

Successive : Fluid Machines

Course Objectives:

To learn the various concepts of stability, continuity and Bernoulli's equation; various losses through pipes; to learn the determination of hydraulic coefficients and velocity profile.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the techniques and concept of stability.

CO 2- Learning continuity and Bernoulli's equation.

CO 3- Analyse discharge measuring devices and hydraulic coefficients.

CO 4- Knowledge of different types of pipe losses and determine the velocity profile in a pipe.

List of Experiments:

1. To determine the meta-centric height of a floating ship model.
2. To verify the Bernoulli's Theorem.
3. To determine coefficient of discharge of a Venturimeter.
4. To determine the coefficient of discharge of an Orificemeter.
5. To calibrate a Rotameter.
6. To determine the coefficient of discharge of a Notch (V and Rectangular types).
7. To determine the friction factor for the pipes.
8. To determine the coefficient of contraction, velocity and discharge of an orifice.
9. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
10. To determine velocity profile using Pitot tube.

ME-255C MACHINE DRAWING USING AUTOCAD

B.Tech (Mechanical Engineering) III Semester

No. of Credits: 2

L T P Total

0 0 4 4

Sessional: 30 Marks

Practical : 70 Marks

Total : 100 Marks

Pre- Requisite: Engineering Drawing

Successive : Computer Aided Design

Course Objective:

To understand the procedure of creating drawings of mechanical components using AutoCAD.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Learning the fundamentals of computer aided drafting using AutoCAD.

CO 2- Understanding of the drawing standards and gear terminology.

CO 3- Generation of the orthographic views of various mechanical parts using AutoCAD.

CO 4- Expedite the Isometric views and Assembly of various mechanical parts using AutoCAD.

Syllabus:

UNIT I CAD: Introduction to AutoCAD, 2D Drafting using AutoCAD, Orthographic and Isometric modelling using AutoCAD, Introduction to Assembly modelling and sectioning using AutoCAD.

UNIT II Drawing standards: Introduction to Limits, fits and Tolerance (Dimensional and Geometrical tolerance), Surface finish representation. Gear: Gear terminology, I.S. convention representation of assembly of spur gears, helical gears, bevel gears, worm and worm wheel.

UNIT III Orthographic views of machine parts / components: Dimensioning, Sectioning using AutoCAD. Exercises on Lathe Tail stock, Machine vice, Steam stop valve, Drill jigs and Spur Gear using AutoCAD.

UNIT IV Isometric views and Assembly drawings: Piston cylinder arrangement, 3D views of cone, pyramid, wedge, cylinder, Connecting rod, Spur Gear and Engine parts in AutoCAD.

Text Books:

1. Engineering Graphics with Auto CAD 2002 - JamesD.Bethune, Pearson Education.
2. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.

Reference Books:

1. A Text Book of Machine Drawing: Laxmi Narayana and Mathur, M/s. Jain Brothers, New Delhi.
2. Machine drawing: N Sidheshwar, Kannaieh, V S Sastry, TMH, New Delhi.
3. Engineering Drawing and Computer Graphics: Kohli and Gupta; Tech India Publication series.

ME-202C KINEMATICS OF MACHINES

B.Tech (Mechanical Engineering) IV Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional:

25 Marks

Theory:

75 Marks

Total :

100 Marks

Duration of Exam:

3 hrs.

Pre- Requisite: Engineering Mechanics

Successive: Dynamics of Machines, Machine Design

Course Objectives:

To develop the concept of geometric aspects of motion and its profile in various machine members.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Develop the concept of mechanism and machines.

CO 2- Understand the concept of Motion Analysis in Mechanism.

CO 3- Development the concept of Synthesis of Mechanisms.

CO 4- Knowledge of concept of Gears and its assembly.

CO 5- Learn the analysis and geometry of CAM profiles.

CO 6- Explore the concept of Brakes and its applications.

Syllabus:

UNIT I Mechanism and Machine: Links, Kinematic pairs, Degree of freedom, Kinematic Chain, Binary, Ternary, Quaternary Links and Joints, Inversions of Mechanisms, Application Lower Pairs : Pantograph, Straight Line Mechanisms, Approximate Straight Line Motion Mechanism: Steering gears: Davis Steering gear, Ackermann Steering gear, Universal Hook's Joint

UNIT II Motion Analysis in Mechanism: Concept of Instantaneous centre method to analyze Velocity in Simple Mechanism, Method for locating an instantaneous centre. Relative Velocity method to analyze Velocity and acceleration, Rubbing velocity at pin joints. Coriolis acceleration component.

UNIT III Synthesis of Mechanisms: Kinematics synthesis of Mechanisms, Type, number and dimensional synthesis, function generation, path generation and body guidance, Two and three position synthesis of four bar and slider crank

mechanisms by graphical methods, Freudenstein's equation, precision positions, structural error; Chebychev spacing, transmission angle, problems.

UNIT IV Gears: Concept of gears and its type, Terminology, Law of gearing, velocity of sliding, Forms of Teeth, Cycloid profile teeth, Length of path of contact, length of arc of contact, Number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth to avoid interferences on gear and wheel, Concept of Helical gears, spiral gears, Gear Trains: Types of gear trains: simple gear train, compound gear train, Reverted gear train, Epicyclic gear train.

UNIT V Cams: Types of followers, Nomenclature of followers, Motion of follower, Simple harmonic motion of follower, Uniform acceleration and retardation, Cycloidal motion, cam profile construction, cam profile for roller followers.

UNIT VI Brakes and Dynamometers: Types of brake: Simple shoe brake, Band Brake, Band and Block brake, Internal expanding shoe brake, Dynamometer, Absorption Dynamometer: Prony brake dynamometer, Transmission Dynamometer: Epicyclic train dynamometer.

Text Books:

1. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.
2. Theory and Machines: V.P. Singh, Dhanpat Rai & Company.
3. Theory and Machines: S.S. Rattan, Tata McGraw Hill.

References:

1. NPTL lectures

ME-204C MATERIAL SCIENCE AND ENGINEERING

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 4

L T P Total

4 0 0 4

Sessional: 25 Marks

Theory : 75 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Chemistry

Successive: Advanced Solids of Mechanics, Machine Design

Course Objective:

The objective of this course is to make the students aware of importance of materials, their structure, properties, application and the science behind them. The students will also be sensitized about the environmental and societal issues related to use of materials.

Course Outcomes (COs): After studying this course, students will be able:

CO 1- know about the basics of materials, crystallography and classify crystal defects.

CO 2- Comprehend the deformation phenomena, mechanisms of fracture and modes of failure in materials.

CO 3- Classify solid solutions and interpret equilibrium phase diagrams of ferrous and non-ferrous alloys.

CO 4- Select suitable heat-treatment process to achieve desired properties of metals and alloys.

CO 5- Understand the application of advanced engineering materials and to analyse Environmental and societal issues related to material science and Engineering.

Syllabus:

UNIT I The Structure of Crystalline Solids: Introduction, basic concepts, Unit Cells, Metallic Crystal Structures, Density Computations, Polymorphism and Allotropy, Crystal Systems, Point Coordinates, Crystallographic Directions, Crystallographic Planes, Linear and Planar Densities, Single Crystals, Polycrystalline Materials, Anisotropy, Imperfections in Solids, Point Defects, Impurities in Solids, Solid solutions, Linear Defects, Interfacial Defects, Bulk or Volume Defects.

UNIT II Deformation and Failure of Metals and Alloys: Introduction, Characteristics of Dislocations, Slip Systems, Slip in Single Crystals, Plastic Deformation of Polycrystalline Materials, Deformation by Twinning, Strain Hardening, Recovery, Recrystallization, Grain Growth.

Fundamentals of Fracture: Failure vs. Fracture, Ductile Fracture, Brittle Fracture, Principles of Fracture Mechanics, Fatigue, Cyclic Stresses, The S–N Curve, Crack Initiation and Propagation, Factors that affect Fatigue Life, Environmental Effects, CREEP, Generalized Creep Behaviour, Stress and Temperature Effects.

UNIT III Phase Diagrams: Introduction, Solubility Limit, Phases, Microstructure, Phase Equilibria, One-Component (or Unary) Phase Diagrams, Binary Isomorphous Systems, Interpretation of Phase Diagrams, The Gibbs Phase Rule, Tie Line Rule and Lever Rule, Development of Microstructure in Isomorphous and Eutectic Binary Alloys, Invariant Reactions, The Iron–Iron Carbide (Fe–Fe₃C) Phase Diagram, Development of Microstructure in Iron–Carbon Alloys,

UNIT IV Phase Transformations and Thermal Processing of Iron- Carbon Alloys: Introduction, Isothermal Transformation Diagrams, Continuous Cooling Transformation Diagrams, Introduction to Thermal Processing of Metals, Annealing, Hardening and Tempering Processes for Steels.

UNIT V Advanced Engineering Materials: Ceramics and their application, Silicate Ceramics, Carbon, Carbon Nanotubes, Particle-Reinforced Composites, Large-Particle Composites, Dispersion-Strengthened Composites, Fiber-Reinforced Composites, Influence of Fiber Length, Orientation and Concentration, The Fiber Phase, The Matrix Phase, Polymer-Matrix Composites, Metal-Matrix Composites, Ceramic-Matrix Composites, Carbon–Carbon Composites, Shape-Memory Alloys, Bio-materials.

UNIT VI Economic, Environmental, and Societal Issues in Materials Science and Engineering: Introduction, Component Design, Materials, Manufacturing Techniques, Recycling Issues in Materials Science and Engineering, Biodegradable and Bio-renewable Polymers/Plastics.

Text Books:

1. Material Science and Engineering-An Introduction: Callister, W.D., John Wiley & Sons, Delhi.
2. Elements of Material Science and Engineering: Lawrence H. VanVlack, Pearson Education India.

3. Introduction to Engineering Materials: B. K. Agarwal, Tata McGraw-Hill Education, India
4. Material Science - Narula, Narula and Gupta. Tata McGraw-Hill Education, India

Reference Books:

1. The Essence of Materials for Engineers Robert W., Jr. Messler-Jones and Bartlett Publishers, Inc., USA
2. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi
3. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi

ME-206C INTERNAL COMBUSTION ENGINES

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Chemistry, Thermodynamics

Successive: Automobile Engineering, Power Plant Engineering, Applied Thermodynamics

Course Objectives:

To study the concept and details of internal combustion engines with gas turbines. Study of carburetion, injection, ignition system with new technologies, lubrication, cooling system and Fuel cells.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the Air Standard Cycles with their applications.

CO 2- Analyze carburetion, injection and ignition systems with new technologies.

CO 3- Conceptualize Combustion System of IC Engines.

CO 4- Knowledge of Lubrication and Cooling systems and fuel cells.

CO 5- Analyses the gas turbines.

Syllabus:

UNIT I Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; performance curves. Problems.

UNIT II Carburetion, Fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburettor, Requirements of a diesel injection system; types of injection systems; petrol injection, Electronic

Fuel Systems, Injector Sequencing & Management, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

UNIT III Combustion in I.C. Engines: S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

UNIT IV Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

UNIT V Fuel Cell: Different fuel cell technologies – catalysts used, Fuel cell efficiencies, comparison with Carnot efficiencies, Thermodynamic advantage of electrochemical energy conversion, Mass transport in electrochemical cells, Ideal current – voltage relationship in fuel cells, Fuel cell stacks, Cogeneration, Limitations of existing technology, Approaches to improve existing technology.

UNIT VI Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

Text Books:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub. - Tata McGraw Hill.
3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI, India

Reference Books:

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York.

ME-208C FLUID MACHINES

B.Tech (Mechanical Engineering) IV Semester

No. of Credits: 3	Sessional	: 25 Marks
L T P Total	Theory	: 75 Marks
3 0 0 3	Total	: 100 Marks
	Duration of Exam	: 03 Hours

Pre- Requisite: Fluid Mechanics

Successive: Power Plant Engineering, Applied Thermodynamics

Course Objectives:

To learn the basic principle, design and analysis of fluid machines.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Application of momentum equation and its application.

CO 2- Understand the construction, working principle and design analysis of hydraulic turbines.

CO 3- Expedite construction, working principle and design analysis of pumps.

CO 4- Knowledge of the design of a prototype on the basis of dimensional analysis.

Syllabus:

UNIT I Impact of Free Jets: Impulse – momentum principle; Forces on a stationary, inclined and curved plate; Forces on moving single inclined & curved plate; Forces on series of vanes; jet propulsion of ships. Problems.

UNIT II Impulse Turbines: Classification of turbines; component parts; construction and operation of a Pelton wheel; effective head; available head; design aspects; speed ratio; flow ratio; jet ratio; number of jets; number of buckets and working proportions; Energy conversion; Performance Characteristics; governing of impulse turbines. Problems.

UNIT III Reaction Turbines: Advantages, disadvantages, use and limitations of different turbines, Component parts; construction and operation of a Francis, Propeller and Kaplan turbine; governing mechanism; draft tube - its function and different forms; velocity triangles; slow; medium and fast runners; work done by the turbine runner; working proportions and design parameters; Performance Characteristics; Problems.

UNIT IV Centrifugal Pumps: Introduction; Working and components; Classification; velocity diagrams and work done; vane shape; Losses and efficiencies; minimum starting speed; cavitation and maximum suction lift; net positive suction head; design considerations; multistage pumps. specific speed; performance characteristics; Brief introduction to axial flow, mixed flow and submersible pumps; Problems.

UNIT V Reciprocating Pumps: Introduction; Working and components; Classification; slip; work and power input; Indicator diagram; Effect of piston acceleration and pipe friction on indicator diagram; Maximum speed; Multi cylinder pumps; air vessels and their utility; rate of flow into or from the air vessel; characteristic curves; Brief introduction to screw pump, gear pump, vane pump, radial piston pump and hydraulic ram; Problems.

UNIT VI Dimensional Analysis and Model Similitude: Dimensions; Dimensional homogeneity; Rayleigh's method and Buckingham's π -method; Dynamic forces; dimensionless numbers and their significance; Model testing and similitude; Similitude laws; Model testing of turbines and pumps.

Text Books:

1. Hydraulic Turbines- Daughaty R L- McGraw Hill Book Company
2. Hydraulics & Fluid Mechanics including hydraulic machines – PN Modi & SM Seth; Pub. - Standard Book House; New Delhi
3. Hydraulic Machines – Jagdish Lal; Metropolitan

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering – D S Kumar; S K Kataria and Sons.
2. Hydraulic Turbines- Robert Long Daugherty; Read Books.
3. Centrifugal and Axial Flow Pumps- Stepanoff A J- John Wiley and Sons.
4. Advanced Fluid Mechanics and Fluid Machinery- Binder R C- Prentice Hall.
5. Fluid Mechanics and Thermodynamics of Turbomachinery- S.L. Dixon- Elsevier.

ME-210C MANUFACTURING TECHNOLOGY AND METROLOGY

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 3	Sessional	: 25 Marks
L T P Total	Theory	: 75 Marks
3 0 0 3	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Pre- Requisite: Manufacturing Process

Successive: Welding Technology, Production Planning and Control

Course Objectives:

The main objectives of this course are to provide basic knowledge about chip formation, materials of cutting tools, components of jigs, fixtures, knowledge about welding and non-conventional processes and measuring instruments used in quality control of components.

Course Objectives (COs): At the end of the course, the student shall be able to:

CO 1- Acquire knowledge about mechanics of chip formation and to identify the factors related to tool wear and machinability.

CO 2- Learn about different gear manufacturing and gear finishing operations.

CO 3- Select the proper cutting tool material and components of jigs and fixtures.

CO 4- Understand the basics principles of non-conventional machining processes and their applications.

CO 5- Identify and select different measuring instruments for the inspection of different components.

Syllabus:

UNIT I Mechanism of Metal Cutting: Deformation of metal during machining, nomenclature of lathe, milling tools, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces. Cutting speed, feed and depth of cut, surface finish. Temperature distribution at tool chip interface. Numericals on cutting forces and Merchant circle.

UNIT II Tool Wear and Machinability: Types of tool wear, tool life, factors governing tool life, Machinability: Definition and evaluation. Economics of machining, Numerical on tool life.

UNIT III Gear Manufacturing: Introduction, methods of manufacture. Gear generation and forming: Gear cutting by milling, single point form tool, gear hobbing and shaping. Gear finishing operations: Gear shaving, gear burnishing, gear grinding, lapping.

UNIT IV Cutting Tool Materials & Cutting Fluids: Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, Purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid

Jigs & Fixtures: Introduction, location and location devices, clamping and clamping devices, Drill Jigs, Milling Fixtures.

UNIT V Unconventional Machining Processes: introduction, classification of unconventional machining processes, Abrasive jet machining: Principles, advantages, disadvantages and applications. Ultrasonic machining: Principles, advantages, disadvantages and applications. Electro-chemical machining and grinding: Principles of operation, advantages, disadvantages and applications. Electric discharge machining: Principles, advantages, disadvantages and applications. Electron beam machining: principle, advantages, disadvantages and applications. Laser beam machining: Principles and applications.

UNIT VI Metrology : Standards of linear measurement, line and end standards. Limit gauges. Measurement of geometric forms like straightness, flatness, roundness and circularity. Optical projectors, autocollimators. Interferometry: principle and uses of interferometers, optical flat and interferometers. Comparators: types, working principles and magnification range. Measurement of screw threads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement. Introduction to CMM.

Text Books:

1. Manufacturing Technology – Metal cutting and machine Tools: P.N. Rao, T.M.H, New Delhi
2. Workshop Technology -Vol II (Machine Tools) B.S Raghuwanshi, dhanpat Rai and Company.
3. Manufacturing Processes- H S Shan, Cambridge University Press 2nd Edition 2017.

Reference Books:

1. Manufacturing Engg. & Tech, Kalpakian, Serope Addison -Wisly Publishing Co. New York.
2. Modern Machining Processes: P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
3. Text Book of Production Engineering: P.C. Sharma, S.Chand & Sons.

Web Links:

NPTEL Video Lecture ,Web: <http://nptel.ac.in>

ME-212C ADVANCE STRENGTH OF MATERIALS

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 4
L T P Total
3 1 0 3

Sessional: 25Marks
Theory: 75 Marks
Total : 100Marks
Duration of Exam: 3Hours

Pre- Requisite: Mechanics of Solids

Successive: Design and Optimization

Course Objectives:

To understand concept of stress and strain induced in material under various loading conditions. To understand the concept of stresses induced in curves and rotating rings and discs.

Course Outcomes (COs): After studying this course, students will be able:

CO 1- Apply and use energy methods to find force, stress and displacement in simple structures and springs.

CO 2- Understand and determine the stresses and strains in pressure vessels.

CO 3- Knowledge of stress functions, and calculate stresses in rotating rings, discs, and curved beams.

CO 4- Evaluate the behaviour and strength of structural elements subjected to three dimensional stress system.

Syllabus:

UNIT I Energy Methods: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems. Numericals.

UNIT II Springs: Stresses and Deflection of springs by energy method, helical springs under axial load and under axial twist axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs, leaf springs.

UNIT III Thin and Thick Pressure Vessels: Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure,

Derivation of Lamé's equations, radial & hoop stresses and strains in thick and compound cylinders shells subjected to internal fluid pressure. Numericals.

UNIT IV Rotating Rings & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in rotating cylinders, hollow cylinders & solids cylinders. Numericals.

UNIT V Bending of Curved Bars: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

UNIT VI Three Dimensional Stress and Strains: Introduction, Equilibrium equations, Three dimensional stress and strain -principle stresses, Stress and strain invariants, Airy's Stress function, Generalised Hook's law, Strain Rosset Analysis, Strain analysis of composites and Polymers. Numericals.

Text Books:

1. Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India.
2. Mechanics of Materials – (Metric Edition): Ferdinand P. Beer and E. Russel Johnston, Jr. Second Edition, McGraw Hill.
3. Strength of Material- Sadhu Singh- Khanna Publisher.

Reference Books:

1. Book of Solid Mechanics – Kazmi, Tata McGraw Hill
2. Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd.
3. Advanced Mechanics of Solids and Structures – N. Krishan Raju and D.R.Gururaje-Narosa Publishing House.

Web Links:

1. <http://nptel.ac.in/courses/112101095/>
2. <https://www.youtube.com/watch?v=jZRomCtVLHU>
3. <https://www.youtube.com/watch?v=1Ycn81U72G0>

ME-252C KINEMATICS OF MACHINES LAB

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 1	Sessional	: 15Marks
L T P Total	Practical	: 35 Marks
0 0 2 2	Total	: 50 Marks
	Duration of Exam.	: 2 Hours

Pre- Requisite: Kinematics of Machines

Successive: Dynamics of Machines

Course Objectives:

To demonstrate the basic elements of machine members and its arrangement to make a mechanism.

Course Outcomes (COs): After studying this course, students will be able:

CO 1- Understand the various practical demonstrations of mechanism.

CO 2- Knowledge of Motions in mechanism with practical demonstration.

CO 3- Learning the Special purpose machine members used in designing of a machine.

CO 4- Synthesis of working model using the various linkages.

List of Experiments:

1. To study various types of kinematic links, pairs, chains and mechanisms.
2. To study inversions of four bar mechanism, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To generate spur gear involute tooth profile using simulated gear shaping process.
6. To study various types of gears- Helical, cross helical worm and bevel gear.
7. To study various types of gear trains – simple, compound, reverted, Epicyclic and differential.
8. To study types of CAM & followers, to draw the Cam Profile.
9. To study the working of Screw Jack and determine its efficiency.
10. To Fabricate the working Models.

ME-254C MATERIAL SCIENCE AND ENGINEERING LAB

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 1

L T P Total

0 0 2 2

Sessional: 15 Marks

Theory : 35 Marks

Total : 50 Marks

Duration of Exam: 2 Hours

Pre- Requisite: Material Science

Successive: Metallurgy

Course Objectives:

The overall objective of the course is to provide the students with hands-on experience in (i) basic experimental techniques, (ii) data analysis. Small groups of about 5 to 6 students work as teams in each laboratory session with the reports prepared independently.

Course Outcomes (COs): After studying this course, students will be:

CO 1- Learn the principles of materials science and engineering through lab investigation.

CO 2- Prepare formal laboratory reports describing the results of experiments.

CO 3- Operate basic instruments in materials science and engineering.

CO 4- Understand the basic structure of materials and ability to interpret the data from the experiments.

List of Experiments:

1. To study crystal structures with the help of models.
2. To study crystal imperfections with the help of models.
3. To prepare a small specimen and mount it using hot mounting press.
4. To study optical metallurgical microscope.
5. To analyze microstructures of given Mild Steel/Aluminum specimen.
6. To analyze microstructure of given Grey cast iron specimen.
7. To harden and temper a given steel specimen.
8. To anneal a given hardened steel specimen.
9. To analyze microstructure of quench hardened steel specimen.
10. To analyze the properties of various types of plastics.

ME-256C INTERNAL COMBUSTION ENGINES LAB

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Theory : 35 Marks
Total : 50 Marks
Duration of Exam: 2 Hours

Pre- Requisite: I.C. Engines

Successive: Power Plant Engineering, Aircraft Engine Operation & Maintenance

Course Objectives:

Study and analyze the concept of I.C engines, I.C. engine testing and variable compression test rig. Study of carburetion and lubrication, cooling system and pollution control system.

Course Outcomes (COs): After studying this course, students will be able:

- CO 1-** Understand the how to prepare the graph between bhp, ihp, fhp vs speed by using variable compression test rig.
- CO 2-** Knowledge of functions of 4 stroke and two stroke engines.
- CO 3-** Learn Combustion System of IC Engines with Lubrication and Cooling system.
- CO 4-** Familiarization of the pollution control system.

List of Experiments: (Students have to perform at least 8 experiments from the given list)

1. To study 2 stroke Diesel and Petrol Engine.
2. To study 4 stroke Diesel and Petrol Engine.
3. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
4. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp vs speed (ii) volumetric efficiency & indicated specific fuel consumption vs speed.
5. To prepare the graph between curves (i) bhp, ihp, fhp vs speed by using variable compression test rig.
6. To measure pollution emission e.g. CO & Hydrocarbons in the exhaust of 2- stroke / 4- stroke petrol engine by using gas analyzer.
7. Perform disassembly and assembly of Engine head.
8. Study of Valve Timing Diagram.
9. Study on engine cooling system.
10. Study of P- θ diagram.

11. To determine Brayton cycle efficiency experimentally.
12. To determine efficiency of intercooled air compressor.

ME-258C FLUID MACHINES LAB
B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 1
L T P Total
0 0 2 2

Sessional: 15 Marks
Practical: 35 Marks
Total: 50 Marks
Duration of Exam: 2 Hours

Pre- Requisite: Fluid Machines

Successive: Power Plant Engineering

Course Objectives:

To learn the construction, working and principle of fluid machines; draw and analyse performance characteristics of fluid machines.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the concept of momentum equation.

CO 2- Knowledge of construction, working principle and performance of hydraulic turbines.

CO 3- Learn construction, working principle and performance of pumps.

CO4- Explore construction, working principle and performance of hydraulic ram.

List of Experiments:

1. To determine the impact of jet on the different types of plates.
2. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
3. To draw the constant head; constant-speed and constant efficiency curves of Pelton turbine.
4. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
5. To draw the constant head; constant speed and constant efficiency curves of Francis turbine.
6. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
7. To draw the constant head; constant speed and constant efficiency curves of Kaplan turbine.
8. To study the constructional details and draw the characteristic curves of Centrifugal pump.
9. To study the constructional details and draw the characteristic curves of Reciprocating pump.
10. To analyze the construction details of a Gear oil pump and its performance curves.
11. To analyze the constructional details of a Hydraulic Ram and determine its various efficiencies.

ME-301C DYNAMICS OF MACHINES

B.Tech (Mechanical Engineering) V Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Kinematics of Machines, Engineering Mechanics

Successive: Tribology

Course Objectives:

To have a comprehensive knowledge of the forces and its effects causing the motion in a Mechanism.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the Static and Inertia Force Analysis.

CO 2- Explore the concept of Balancing of rotating and reciprocating masses.

CO 3- Knowledge of concept of Mechanical Governor.

CO 4- Develop the concept of Gyroscope and its application.

CO 5- explore the concept of Mechanical Vibration.

CO 6- Carry out the Vibration Analysis.

Syllabus:

UNIT I Static and Inertia Force Analysis: Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms. D-Alembert's Principle, Forces on the reciprocating parts of an engine considering friction and inertia of moving parts, dynamically equivalent system, Torque exerted on the crank shaft, considering the weight of the connecting rod.

UNIT II Balancing: Balancing rotating mass in single and several planes, Balancing of reciprocating engine, concept of Partial balancing, Primary and secondary balancing of multi-cylinder inline engine and radial engine, Method of direct and reverse cranks.

UNIT III Governors: Types of Governor, Watt Governor, Porter governor, Proell Governor, Hartnell Governor, Wilson-Hartnell governor, Sensitivity, Stability, Isochronisms, Hunting, Governor Effort and Power, controlling force.

UNIT IV Gyroscopic effect: Spinning and precession, gyroscopic couple, Effect of Gyroscopic couple on the stability of automotive vehicles: Stability of four wheelers.

UNIT V Mechanical Vibration: Definition, parts of vibration, types: longitudinal, transverse, torsional, transient, Free and Forced Vibration of single DOF ,Vibration Absorber : tuned and damped absorber (qualitative treatment only), un-tuned viscous damper.

UNIT VI Vibration Analysis: Introduction, Influence coefficient, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, calculation of natural frequencies by Rayleigh method, Vibration Isolation.

Text Books:

1. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.
2. Theory and Machines: V.P. Singh, Dhanpat Rai & Company.
3. Theory and Machines: S.S. Rattan, Tata McGraw Hill.

References:

1. NPTL lectures
2. Mechanism and Machines: J S Rao,
3. Mechanical Vibrations : G.K.Grover – Nem Chand & Bros., Roorkee, INDIA

ME-303C REFRIGERATION & AIR CONDITIONING

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: Air Conditioning Equipments, Estimation and Design of RAC Plants

Course Objectives:

Make students familiar with the different refrigeration systems, air-conditioning systems, eco-friendly refrigerants used.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the air refrigeration, vapour compression refrigeration, vapour absorption, steam jet refrigeration systems and different type of refrigerants.
- CO 2-** Expedite the working of single stage, multistage and cascade refrigeration.
- CO 3-** Knowledge of psychrometry and different psychrometric processes. Understand and evaluate cooling and heating load and design of HVAC system.
- CO 4-** Develop and design RAC systems and evaluate different expansion and control devices.

Syllabus:

UNIT I Introduction: Definition , Methods of refrigeration, Industrial Refrigeration; Unit of refrigeration; Coefficient of performance (COP) Refrigerants- Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly new Refrigerants and their analysis.

Air Refrigeration Systems: Carnot refrigeration cycle. Limitations of Reversed Carnot cycle, Brayton refrigeration or the Bell Coleman air refrigeration cycle; Air-craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, comparison of different air refrigeration systems, advantages and disadvantages of air refrigeration cycle, Actual air conditioning system with controls, problems.

UNIT II Simple Vapour Compression (VC) Refrigeration Systems: Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on P-V, T-S and

PH diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

Multistage Vapour Compression (VC) Refrigeration Systems: Necessity of compound compression, Compound VC cycle, Inter-cooling with liquid sub-cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers, Production of low temperatures: Introduction to Cryogenics, Limitations of Vapour compression system for production of low temperature, Multistage refrigeration system, Two and three stage cascade systems. Problems.

UNIT III Other Refrigeration Systems: Simple Absorption Systems, Practical Ammonia Absorption System, COP of the Absorption System, Lithium bromide-Water Absorption Refrigeration Systems and Electrolux Refrigeration system, Solar energy based absorption refrigeration systems, Steam Jet Refrigerating System-Introduction, Analysis, Relative merits and demerits, Performance Applications.

UNIT IV Psychrometry & Air Conditioning Processes: Properties of moist Air, Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychrometric processes in air washer, Problems

UNIT V Heating and cooling load calculation for HVAC system design: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Comfort chart, Problems.

UNIT VI Equipment selection for HVAC system: Air distribution system; Basic of Duct systems; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories, Different types of compressor used in refrigeration.

Text Books:

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India.
2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi.

Reference Books:

1. A course in Refrigeration & Air Conditioning – Arora & Domkundwar, Dhanpat Rai & sons.
2. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
3. Refrigeration & Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.
4. Refrigeration and Air Conditioning by D.S.Kumar, S.K.Kataria & Sons, New Delhi.

ME-305C INDUSTRIAL ENGINEERING
B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Manufacturing Process

Successive: Advanced Manufacturing Processes

Course Objectives:

To study various concepts and practises of industrial engineering used in industries. Able to design, develop, implement, and improve production systems that include people, materials, information, equipment and environments aligned with success of companies.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Describe and apply various techniques of method study and work measurement.

CO 2- Discuss production system and factors affecting productivity and strategies for its improvement.

CO 3- Learn various manufacturing cost components and perform cost analysis.

CO 4- Apply sales forecasting and materials management techniques.

CO 5- Identify objectives, variables and apply techniques and strategies for production planning & control of a production system.

Syllabus:

UNIT I Production system and Productivity: Introduction to production systems, Aim of production systems, generalized model of Production systems, Types and characteristics of production systems, Life cycle approach to production management, Product life cycle, Plant location, Plant layout, objectives, types, comparison and application of different types of layouts. Productivity definition, various methods of measurement, Factors effecting productivity, Strategies for improving productivity.

UNIT II Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate & efficiency, Break even Analysis, Numerical Problems.

UNIT III Work Study: Definition, Objectives, Method study, Principle of motion economy, Techniques of method study – Various charts, THERBLIGS, Work measurement - various methods, Time Study - PMTS, determining time, Work sampling. Numerical Problems.

UNIT IV Materials Management : Strategic importance of materials in manufacturing industries, Relevant costs, Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Inventory control systems - P,Q,Ss Systems, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED,SCM , Numerical Problems.

UNIT V Forecasting: Importance, Objectives, Forecasting and Prediction, Types, Classification of Forecasting Methods, Forecast Errors, Costs and Accuracy of Forecasts, Numerical Problems.

UNIT VI Production Planning & Control (PPC) : Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermittent production systems, Gantt chart, Sequencing - Johnson algorithm for n-Jobs- 2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines Various means of measuring effectiveness of PPC, Numerical Problems.

Text Books:

1. Production & Operations Management – Chary, TMH, New Delhi.
2. Modern Production Management – S.S. Buffa, Pub.John Wiley.

Reference Books:

1. Operations Management - Schroeder, McGraw Hill ISE.
2. Operation Management - Monks, McGraw Hill ISE.
3. Production & Operations Management - Martinich, John Wiely SE.
4. Industrial & Systems Engineering - Turner, Mize, Case, Prentice Hall Pub.
5. Industrial Engineering & Operations Management – SK Sharma, Pub-S. K.Kataria
6. Industrial Engineering – Ravi Shankar, Galgotia Pub.

Web Links:

<http://nptel.ac.in/courses/112107143/>

<http://nptel.ac.in/courses/112107142/>

ME-307C MACHINE DESIGN -I
B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Kinematics of Machines, Mechanics of Solids

Successive: Machine Design II

Course Objectives:

To study the concept and details of material selection, allowable stresses and factor of safety.

To study the design of keys, coupling, cotter joints, various types of springs, various types of clutches, thick cylinder and thin cylinders.

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

CO 1- Exploration of different concepts & considerations of machine design.

CO 2- Understanding design of different types of mechanical joints.

CO 3- Learning of design of different types of keys & couplings.

CO 4- Design procedure of transmission of shafts.

CO 5- Design of different types springs.

CO 6- Conceptualisation of design of different types of clutches.

Syllabus:

UNIT I Principles of Mechanical Design: General considerations & procedure of design of machine elements, Engineering materials & their mechanical properties, Selection of material, theories of failures, static loading, factor of safety under different loading conditions, stress concentration, Concept of fatigue failures for dynamic loading.

UNIT II Mechanical Joints: Design of riveted & welding joints under different static load conditions. Design of screwed joints against static load, eccentric loading, Design of cotter joints and knuckle joint.

UNIT III Keys & Couplings: Design of different type of keys; sunk key, saddle key, tangent key, round key & splines. Design of different shaft couplings against torque; Rigid & Flexible couplings.

UNIT IV Transmission Shafts: Design of shaft subjected to static loading: pure torsion, simple bending, combined bending and torsion, combined bending torsion and axial loads. Design of shafts for fluctuating loads.

UNIT V Springs: Terminologies of springs, Different type of springs, Design of helical springs for static & dynamic loading, Eccentric loading, Surge in springs, Springs in series & parallel connection, Type of leaf springs, Design of leaf springs.

UNIT VI Clutches: Various types of clutches, Design of friction clutches; Single plate clutch, Multi-plate clutch, Cone clutch & Centrifugal clutch.

Text Books:

1. Mechanical Engineering Design: Joseph Edward Shigley-MGH, New York.
2. Design of Machine Elements – V.B. Bhandari – MGH.
3. Norton, R. L., Machine design: an integrated approach, Prentice Hall.

Web Links:

NPTEL Courses, <http://www.nptel.ac.in>

ME-351C DYNAMICS OF MACHINES LAB

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 1	Sessional:	15 Marks
L T P Total	Practical:	35 Marks
0 0 2 2	Total:	50 Marks
	Duration of Exam:	2 Hours

Pre- Requisite: Basics of Mechanical Engineering, Dynamics of Machines

Successive: Tribology

Course Objective:

To demonstrate the effects of various forces in balancing, governing and directing in a mechanism.

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

CO 1- Understand the various practical demonstrations of forces in mechanism.

CO 2- Knowledge of various Design features of mechanism with practical demonstration.

CO 3- Learning the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine

CO 4- Prepare practical model using the various linkages.

List of Experiments:

1. To carry out static balancing on static balancing machine.
2. To carry out dynamic balancing on dynamic balancing machine.
3. To determine the moment of inertia of connecting rod by tri-flair suspension pendulum.
4. To determine the moment of inertia of connecting rod by compound pendulum method.
5. To Prepare performance characteristic Curves, and to find stability & sensitivity on Proell, Porter Governors and Hartnell Governor.
6. To Determine gyroscopic couple on Motorized Gyroscope.
7. To Study of different types of brakes and dynamometers and finding out Brake power.
8. To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.
9. To determine the frequency of damped force vibration of a spring mass system.

ME-353C REFRIGERATION & AIR CONDITIONING LAB

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 1	Sessional:	15 Marks
L T P Total	Practical:	35 Marks
0 0 2 2	Total:	50 Marks

Pre- Requisite: Refrigeration and Air-conditioning

Successive: Air Conditioning Equipments

Course Objectives:

To develop domain knowledge in the field of refrigeration and air conditioning. To understand the working of various refrigeration system and various control devices used in refrigeration system.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the vapour compression refrigeration system and vapour absorption system.

CO 2- Application of different compressors used in refrigeration system..

CO 3- Understand functioning of various control devices

CO 4- Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system.

CO 5- Knowledge of how the loading condition changes the COP of the system.

List of Experiments:

1. To determine the C.O.P. and draw P-H and T-S diagrams for the vapour compression Refrigeration System.
2. To find the C.O.P. of the Mechanical heat pump.
3. To find the C.O.P. of the Air and Water heat pumps.
4. To study the cut-sectional models of Reciprocating and Rotary Refrigerant compressor.
5. To analyze the various controls used in Refrigerating & Air Conditioning systems.
6. To find the C.O.P. and capacity of an Ice- plant.

7. To analyze the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.
8. To find the C.O.P. of vapour absorption system.
9. To find the performance parameters of the cooling tower.
10. To find the C.O.P of Water Cooler.
11. To study the chilling plant and its working cycle.
12. To study and find the By Pass factor of heating & cooling coils & plot them on psychometric chart for different inlet conditions.

ME-302C HEAT AND MASS TRANSFER

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: Estimation and Design of RAC Plants, Power Plant Engineering

Course Objectives:

To introduce the basics of three modes of heat transfer and mass transfer under steady state conditions. To introduce the empirical relations for convection (forced, natural, change of phase).

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basic concept of conduction, convection and radiation heat transfer.

CO 2- Formulation of one dimension conduction problems.

CO 3- Application of empirical correlations for both forced and free convection for determines the value of convection heat transfer coefficient.

CO 4- Expedite basic concept of the radiation heat transfer for black and grey body.

CO 5- Learning of thermal analysis and sizing of Heat exchangers.

CO 6- Conceptualization of mode of mass transfer.

Syllabus:

UNIT I Introduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzman's Law. Combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient.

UNIT II Conduction: Thermal conductivity of solids, liquids and gases, factors influencing conductivity and it's measurement. The general differential equation of conduction. One dimensional steady state and unsteady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation, Effect of variable thermal conductivity, Conduction with heat sources, heat transfer from rods heated at one/ both ends. Heat transfer from fins of uniform cross-section. Errors of measurement of temperature in thermometer wells.

UNIT III Convection: Introduction to free and force convection, laminar boundary layer equations on a flat plate and in a tube for free and force convection, simple

Reynold's analogy, Empirical relationship for free and forced convection. Convection with phase change, Description of condensing flow. A theoretical model of condensing flow, Boiling heat transfer, Empirical relationships for convection with phase changes.

UNIT IV Heat Exchangers: Introduction and different types of heat exchangers; Determination of heat exchanger performance by Heat exchanger transfer units and LMTD methods and their limitations, Analysis restricted to parallel and counter flow heat exchanger.

UNIT V Thermal Radiation: Introduction, surface emission properties, absorptivity, reflectivity and transmissivity. Black and non black bodies, Planck's law, Stefan-Boltzman law, Kirchoff's law, Intensity of radiation and Lambert's cosine law.

Radiation exchange between black bodies, Shape factor algebra and it's feature, Heat exchange between non black bodies, Electrical analogy to simple problems. Radiation heat exchange for three gray surfaces, Radiation shield, Non-luminous gas radiation.

UNIT VI Introduction to Mass Transfer: Introduction and modes of mass transfer, Mass and mole concentrations, , molecular diffusion, eddy diffusion, fick's law, General equation of mass diffusion in stationary media, Diffusion of water vapours through air, Convective mass transfer and it's correlations.

Text Books:

1. Kothandaraman, CP., "Fundamentals of Heat and Mass Transfer", Second Edition, New Age International Publishers, Chennai, 1997.
2. Sachdeva, KC, "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publishers, New Delhi, 1996.
3. Holman, J.P., "Heat Transfer", Tata McGraw Hill Book Company, 1988
4. Heat and mass Transfer by D.S.Kumar, S.K.Kataria and Sons, New Delhi.

ME-304C COMPUTER AIDED DESIGN

B.Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Auto CAD, Engineering Drawing, Machine Drawing

Successive: CAM and Automation

Course Objectives:

To understand the fundamentals of CAD and CAE for Design and development of mechanical systems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basic fundamentals of computer aided designing.

CO 2- Learning Transformations and types of surfaces.

CO 3- Exploration of the techniques of 3D modeling of various mechanical parts.

CO 4- Expedite the procedure and benefits of FEA and CAE.

Syllabus:

UNIT I Introduction: Need and Scope of Computer Aided Design, Fundamental of CAD and computer graphics- Application areas, Comparison of CAD with Manual designing, Benefits of CAD, Introduction to 2D Drafting, Isometric to orthographic views generation, Drawing standards, dimensioning and text writing, concept of layers, advanced concepts of CAD software- blocks, UCS, 3D-line, 3D objects, STP, IGES, DXF & DXB file formats. Output primitives- Points and lines, line, drawing algorithms, Program code generation using C/C++.

UNIT II Geometric Transformations: 2-D geometrical transforms- Translation, scaling, rotation, reflection and shear transformations. Matrix representations and homogeneous coordinates, composite transformations, transformations between coordinate systems. 2-D viewing- The viewing pipeline, Window to view port coordinate transformation. 3-D Geometric transformations- Translation, rotation, scaling, reflection and shear transformations, composite transformations. Importance of transformations.

UNIT III Modeling of Curves and Surfaces: Representation of circle, Arc, Ellipse, parabola and hyperbola.

Synthetic Curves: Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines and NURBS.

Types of surfaces used in automotive industry along with their applications. Techniques for modeling of these surfaces in a design packages.

UNIT IV Solid Modeling: Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations. Schemes: B-rep, CSG, Sweep representation, ASM, Primitive instancing, Cell Decomposition Techniques.

UNIT V Finite Element Analysis: Review of stress-strain relation and generalized Hooke's Law, Plane stress and Plane strain conditions; Failure and its type; FOS, Types of FEA. Theories of Failure, Principal stresses and strains, Von-mises stress and Deflection in structural systems.

UNIT VI Computer Aided Engineering: Preprocessing, Elements type, Material defining, Meshing- coarse and fine, optimal mesh, loading and constraints, boundary conditions, solvers, post processing and reviewing the results, validation of the CAE results, Case study using ANSYS software.

Text Books:

1. Ibrahim Zeid *CAD/CAM - Theory and practice* Tata McGraw Hill Publishers.
2. Salomon, D. *Transformations and projections in computer graphics* Springer.
3. Nitin S.Gokhale: *Practical Finite element analysis*.

ME-306C CAM AND AUTOMATION

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3	Sessional	: 25 Marks
L T P Total	Theory	: 75 Marks
3 0 0 3	Total	: 100 Marks
	Duration of Exam	: 3 Hours

Pre- Requisite: Manufacturing Processes

Successive: Industrial Controls, Mechatronics

Course Objectives:

To study and familiarize the students with the advanced machines like NC, CNC, DNC and robotics. To study the basic steps in manufacturing a component on a CNC machine.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basics of NC, CNC, DNC and adaptive control systems.

CO 2- Develop CNC programs to manufacture industrial components.

CO 3- Acquire knowledge about advanced manufacturing systems like FMS and CIM.

CO 4- Demonstrate the knowledge of Robotics in manufacturing industries.

CO 5- Knowledge of basic principle and elements of automation and control in manufacturing.

Syllabus:

UNIT I Introduction to Numerical Control: NC components, NC coordinate systems, Point to point, line and contouring systems, open and close loop control system, Steps in NC manufacturing, Advantages, Disadvantages and Applications of NC, Role of NC/CNC technology in modern manufacturing, Features of CNC system, components and tooling of machining centre and CNC turning centre, Automatic tool changer, Feedback devices: Encoders and linear scale, Features of DNC and adaptive control systems.

UNIT II CNC Programming: Part programming fundamentals, Manual Part Programming, APT Programming, Geometric & motion commands, Post processor commands, Safety measures in CNC programming.

UNIT III Robotics: Introduction, Joints and links used in robots, Robot physical configurations, Joint drive systems, Robot control systems, End effectors, Sensors in robotics, Robot motion systems, Technical features of robot like work volume, precision of movement, speed of movement, weight carrying capacity,

Programming methods of robot, Robot programming languages, Intelligent robots, Vision systems, Applications of Industrial robots, Safety measures.

UNIT IV Flexible Manufacturing System: Components of FMS, FMS equipment & control, Programmable logic controller, Processes interface programming the PLC, Local area network , Automated guided vehicle systems, Automated storage and retrieval system, Operational problem in FMS. Computer Integrated Manufacturing (CIM): Elements of CIM, CIM hierarchy, implementation of processes

UNIT V Computer Aided Process Planning (CAPP): Introduction to CAPP, Variant & Generative methods of CAPP, advantages of CAPP.

UNIT VI Elements of Automation: Power to Accomplish the Automated Process, Program of Instruction, Control System, Advanced automation Functions-safety Monitoring, maintenance and repair Diagnostics. Automatic identification methods-Overview of Automatic Identification Methods, Bar Code Technology, Radio Frequency Identification. Control system components-Sensors, Actuators:electric, hydraulic and pneumatic. Analog-to-Digital Convertors, Digital-to-Analog Convertors, Input/output Devices for Discrete Data.

Text Books:

1. Rao, P.N., CAD / CAM Principles and Applications, McGraw Hill Publishers, New Delhi, 2010.
2. M.P.Groover , Automation, production systems and Computer-integrated Manufacturing, , Eastern Economy Edition.

Reference Books:

1. Ibrahim Zeid and Sivasubramanian, R., CAD/CAM Theory and Practice, Tata McGraw Hill Publications, New Delhi, 2009.
2. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill Publications, 2005.
3. Nanua Singh , System approach to Computer-integrated design and manufacturing, , Wiley India.
4. T. C. Chang, R. A. Wysk and H. P. Wang, Computer Aided Manufacturing, Pearson

ME-308C MACHINE DESIGN- II

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Mechanics of Solids, Machine Design I

Successive: Design and Optimisation, Tribology

Course Objectives:

To study essential concepts of fatigue design and factor of safety selection. To study design components such as shaft design of static and dynamic loading, keys, cylinder, clutches, springs and mechanical joints.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Expose the students to the Design for Production and for variable loading.

CO 2- Impart in depth knowledge of designing of screws and different types of fasteners.

CO 3- Design bearings, selection of bearings for different aspects & lubricants with their properties.

CO 4- Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication.

CO 5- Learn in depth knowledge of flywheels and their design.

CO 6- Understand the design procedure for miscellaneous components such as connecting rod, crankshaft and C- clamp.

Syllabus:

UNIT I Design for Production: Ergonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining. Variable Loading: Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

UNIT II Design of Screws and Fasteners: Thread standards and definitions, mechanics of power screws, threaded fasteners, fastener stiffness.

UNIT III Design of Bearings: Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

UNIT IV Gears: Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth -Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

UNIT V Design of Flywheels: Turning moment diagram, coefficient of fluctuation of energy and speed, design of solid and rimmed flywheel.

UNIT VI Design of Miscellaneous Components: Crane hook, C-clamp, Machine Frame, Crank Shaft and Connecting Rods.

Text Books:

1. Mechanical Engineering Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

Reference Books:

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Machine Design an Integrated Approach: Robert L. Norton, Second Edition –Addison Wisley Longman.

ME-352C HEAT AND MASS TRANSFER LAB

B.Tech (Mechanical Engineering) VI Semester

No. of Credits: 1

L T P Total

0 0 2 2

Sessional: 15 Marks

Theory : 35 Marks

Total : 50 Marks

Pre- Requisite: Heat And Mass Transfer

Successive: Power Plant Engineering

Course Objectives:

To develop domain knowledge in the field of heat and mass transfer with the help of various equipments for measuring conduction, convection and radiation heat transfer.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understanding the conduction heat transfer coefficient.

CO 2- Design and analyze heat transfer system with practical demonstration.

CO 3- Selection of equipments and their practical demonstration in heat transfer design.

CO 4- Knowledge of development about mass transfer.

List of Experiments:

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To measure the emmissivity of the gray body (plate) at different temperature and plot the variation of emmissivity with surface temperature.
7. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
8. To verify the Stefan-Boltzmann constant for thermal radiation.
9. To conduct test on a heat pipe and compare the temperature distribution and rate of heat transfer with geometrically similar copper and stainless steel tubes.
10. To study the two phases heat transfer unit.

11. To determine the water side overall heat transfer coefficient on a cross-flow heat exchanger.
12. Design of Shell and Tube heat exchanger.

ME-354C COMPUTER AIDED DESIGN LAB

B.Tech (Mechanical Engineering) VI Semester

No. of Credits: 1

L T P Total

0 0 2 2

Sessional: 15 Marks

Theory : 35 Marks

Total : 50 Marks

Pre- Requisite: Computer Aided Design

Successive: Design and Optimisation

Course Objectives:

To understand the fundamentals of CAD and CAE for design and development of mechanical systems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Display of the basic fundamentals of modeling package.

CO 2- Explore the surface and solid modeling features.

CO 3- Learning the techniques of 3D modeling of various mechanical parts.

CO 4- To expedite the procedure and benefits of FEA and CAE.

List of Experiments:

1. Introduction to CATIA/ Solidworks and working with sketch mode
2. Working with creating features (Extrude & Revolve), Axis and Planes.
3. Working with the tools like Hole, Round, Chamfer and Fillet.
5. Working with the tools like Pattern, Copy, Rotate, Move and Mirror.
6. Working with advanced modeling tools (Sweep, Blend, Variable section Sweep, Swept Blend & Helical Sweep).
8. Assembly modelling in Pro/E, Generating, editing and modifying drawings in CATIA/Solidworks.
9. FEA of the cantilever beam with concentrated load and UDL using ANSYS package.

ME-356C CAM AND AUTOMATION LAB
B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 1	Sessional	: 15 Marks
L T P Total	Practical	: 35 Marks
0 0 2 2	Total	: 50 Marks

Pre- Requisite: CAM and Automation

Successive: Mechatronics

Course Objectives:

To develop domain knowledge in the field of CNC and robotics. To prepare and execute the program for different components on CNC machine.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Identify different axes, machine zero, home position of CNC machines.
- CO 2-** Prepare part program for drilling, machining and turning operations on CNC machine.
- CO 3-** Apply the programming method of robotic system.
- CO4-** Handle the working of an CNC and robotic system.

List of Experiments:

1. To get knowledge of various safety points in CNC Lab
2. To get knowledge of various safety points in Robotics Lab
3. To perform step turning and facing on MS component using CNC turning centre
4. To perform taper turning on MS component using CNC turning centre
5. To perform OD grooving on MS component using CNC turning centre
6. To perform external threading operation on MS component using CNC turning centre
7. To perform top milling and side milling on MS component using CNC machining centre
8. To perform drilling operation on MS component using CNC machining centre
9. To cut an intricate shape on wire cut- CNC Machine
10. To teach robotic arm a point in space by using teach pendant
11. To draw a triangle in particular frame by using KR-16 robotic arm
12. To draw the above triangle in different frame with the same programme
13. To construct an array of 3*3 by using robotic arm
14. To make a complicate shape involving arcs and circles by using teach pendant

ME-402C OPERATIONS RESEARCH

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 4
L T P Total
3 1 0 4

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Numerical Methods

Successive: Project Management

Course Objectives:

Study the role of operational research in decision making. Learn, identify and develop operational research models from the verbal description of the real system. Understand the mathematical tools that are needed to solve optimisation problems. To study various types of deterministic and stochastic models for operations research viz. linear programming, waiting time model, project line model, transportation model, simulation.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Discuss the role of operations research in decision-making, and its applications in industry and should be able to formulate and design real-world problems through models & experiments.
- CO 2-** Knowledge of various types of deterministic models like linear programming, transportation model etc.
- CO 3-** Explore various types of stochastic models like waiting line model, project line model, simulation etc.
- CO 4-** Deduce the relationship between a linear program and its dual and perform sensitivity analysis.
- CO 5-** Describe different decision making environments and apply decision making process in the real world situations.

Syllabus:

UNIT I Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

UNIT II Programming (LP): Programming definition, formulation, solution- graphical, simplex, BIG-M methods, Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT III Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepping stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

UNIT IV Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

UNIT V Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, Introduction to crashing of network & resources leveling in project, problems.

UNIT VI Simulation and Decision Theory: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, Decision process, SIMON model, types of decision making environment - certainty, risk, uncertainty, decision making with utilities, problems.

Note: Concerned software's may be used to solve OR problems.

Text Books:

1. Operation Research – TAHA, PHI, New Delhi.
2. Quantitative Techniques- Vohra, TMH, New Delhi

Reference Books:

1. Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2. Introduction to Operations Research – Churchman, Ackoff, Arnoff. Pub. John Wiley
3. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
4. Operation Research – Sharma, Gupta, Wiley Eastern, New Delhi.
5. Operation Research – Philips, Revindran, Solgeberg, Wiley ISE.

Web Links:

<http://nptel.ac.in/courses/112106134/>

<http://nptel.ac.in/courses/112106131/>

ME-309C PRINCIPLES OF MANAGEMENT (DSE - I)

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: None

Successive: Quality Management

Course Objectives:

To know the general principles of management. To understand the various aspects of marketing, service and maintenance management. Able to develop the proper operation strategy.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand various functions and aspects of management.

CO 2- Apply marketing concepts and tools for successful launch of a product.

CO 3- Knowledge of various aspects of service management.

CO 4- Learn the role of maintenance management.

CO 5- Application of various management techniques.

CO 6- Develop the proper operations strategy.

Syllabus:

UNIT I Introduction: Concept and significance of Management, Functions of management and their interrelationship, Management thoughts, Nature & purpose of management, Management- an art or science, Management vs. administration, Levels of management and skills required, Management functions, Branches of management, Management model.

UNIT II Marketing: Evolution of modern marketing concept, Functions of marketing management, Advertisement- Importance, choice of Media and criticism, Marketing mix, Marketing Research Process.

UNIT III Service Management : Introduction, Definition and characteristics of service, Intangibility aspects, service matrix and model, SERVQUAL and SERVPERF

UNIT IV Maintenance Management : Introduction, Objectives, Maintenance Costs, Types, TPM

UNIT V Management Techniques: Conventional management tools, applications of cause & effect diagram, Pareto analysis, Force field analysis, Introduction to techniques- JIT, SCM, ERP, Six Sigma, TQM.

UNIT VI Operations Strategy: Introduction, Operation Decisions, Operations Priorities, Components, Types, Framework, Development and Implementation, Porter's Five Forces model.

Text Books:

1. Claude S. George. , Management for Business and Industry, PHI Private Ltd.
2. Chhabra T. N., Principles and Practices of Management, Dhanpat Rai & Co.
3. Prasad L. M., Principles and Practices of Management, Sultan Chand & Sons
4. Gupta C. B., Management (Theory and Practice), Sultan Chand & Sons

Reference Books:

1. Telsang, M., Industrial Engineering and Production Management, S.Chand
2. Koontz, H. Essentials of Management, Tata McGraw-Hill Education

ME-311C NEW VENTURE CREATION (DSE - I)

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Industrial Engineering

Successive: Production Planning and Control

Course Objectives:

To understand entrepreneurship and entrepreneurial process in context of economic development. Able to launch a new venture by identifying the entrepreneurial opportunities, support and resource requirements.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand entrepreneurship and entrepreneurial process and its significance in economic development.
- CO 2-** Develop an idea of the support structure and promotional agencies assisting ethical entrepreneurship.
- CO 3-** Identify entrepreneurial opportunities, support and resource requirements to launch a new venture within legal and formal frame work.
- CO 4-** Apply Develop a framework for technical, economic and financial feasibility.
- CO 5-** Evaluate an opportunity and prepare a written business plan to communicate business ideas effectively.
- CO 6-** Knowledge of stages of establishment, growth, barriers, and causes of sickness in industry to initiate appropriate strategies for operation, stabilization and growth.

Syllabus:

UNIT I Entrepreneur and Entrepreneurship: Introduction; Entrepreneur and Entrepreneurship; Role of entrepreneurship in economic development; Entrepreneurial competencies and motivation; Institutional Interface for Small Scale Industry/Enterprises.

UNIT II Establishing Small Scale Enterprise: Opportunity Scanning and Identification; Creativity and product development process; Market survey and assessment; choice of technology and selection of site.

UNIT III Planning a Small Scale Enterprises: Financing new/small enterprises; Techno Economic Feasibility Assessment; Preparation of Business Plan; Forms of business organization/ownership.

UNIT IV Operational Issues in SSE: Financial management issues; Operational/project management issues in SSE; Marketing management issues in SSE; Relevant business and industrial Laws.

UNIT V Performance appraisal and growth strategies: Management performance assessment and control; Causes of Sickness in SSI, Strategies for Stabilization and Growth.

UNIT VI Life cycle of production management: Stages in life cycle of production management and Major managerial Decisions involved in each stage.

Text Books:

1. Bruce R Barringer and R Duane Ireland, Entrepreneurship: Successfully Launching New Ventures, 3rd ed., Pearson Edu., 2013.
2. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.

Reference Books:

1. Dr. S.S. Khanka, Entrepreneurial Development (4th ed.), S Chand & Company Ltd., 2012.
2. Dr. Vasant Desai, Management of Small Scale Enterprises, Himalaya Publishing House, 2004.

ME-313C WELDING TECHNOLOGY (DSE - I)

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Manufacturing Process

Successive: Project work

Course Objectives:

To study essential concepts for welding processes. To study various techniques for weld testing. To study the concept special welding processes and welding automation.

Course Outcome (COs): At the end of the course, the student shall be able to:

- CO 1-** Principles and applications of oxyacetylene and electric arc welding.
- CO 2-** Understand various types of weld testing.
- CO 3-** Knowledge of techniques of welding automation.
- CO 4-** Methods of advanced and special welding processes.

Syllabus:

UNIT I Oxy-Acetylene Welding: Introduction: Welding processes and their principles, Industrial Applications, Principles of Oxy- Acetylene Welding, Procedure, Types of flames, Popping, Flash Back and Fire. Equipment and Accessories: Torches, Regulators, Pressure Gauges, Gas Cylinders, Filler Rods and Welding Fluxes. Welded Joints and their Defects: Types of Joints and Welding Positions, Common Welding Defects and their control.

UNIT II Electric Arc Welding: Principle of Electric Arc Welding: Principle, Welding Procedure, Arc Length, Arc Force and Arc Blow. Equipment and Accessories: Welding Machines, A.C. and D.C. Transformers, Motor Generators, Rectifiers, Use of Tong Tester for measuring welding currents, Types of Electrodes and Indian system of classification and coding of covered Electrodes for Mild Steels.

UNIT III Special and Allied Welding Processes: Resistance Welding: Principle, Types and Applications, Equipment and Machinery required. Metal Inert Gas Arc Welding (MIG): Principle, Advantage of Gas Shielded Arc Welding, Types of

Metal Transfer, Welding Equipment and Shielding Gases, MIG Welding and its components. CO₂ Welding: Difference from MIG Welding, Principle of operation, Welding Equipments, Welding Parameters, Joint Design, Welding Procedure, Advantages, Disadvantages and Applications. Tungsten Inert Gas Arc Welding: Welding Equipment-Electrodes, Inert gases and Torches, Inert gas shielded, Spot welding Processes. Submerged Arc Welding: Principle of the Process and its Applications, Fluxes and Welding Rods. Soldering and Brazing: Soft and Hard Solders, Fluxes, Soldering Iron, Soldering procedure, principle of Brazing and different methods of Brazing, Comparison between Brazing and Soldering.

UNIT IV Destructive Testing of Welds: Destructive tests: their advantage and Types such as Tensile Test, Bend Test, Impact Test, Hardness Test, Fatigue Tests, Equipment required and the test piece Geometry. Computer systems for Welding Engineering: Introduction, computer systems, software for welding engineers, magdata, weldcost, weldvol, distortcalc, cutbest, weldbest, ferrite predictor and weld selector.

UNIT V Non Destructive Testing of Welds: Non Destructive Tests: their Advantages and Limitations, Comparison with Destructive Tests, Visual Examination, Dye Penetrant Inspection, Magnetic Particle Inspection, X-Rays and Gamma Rays Inspection and Ultrasonic Inspection of Welds. Standards/ codes for welding.

UNIT VI Automation in Welding: Introduction, Manual Welding, Semi-Automatic Welding, Automatic Welding, Welding Mechanization, Flexible Automated Welding, Robotic Welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system.

Text Books:

1. Welding and Welding Technology by R. Little- Tata McGraw Hill Publication.
2. Welding Processes and Technology by R. S. Parmar- Khanna Publication.

Reference Books:

1. Welding Technology by Koeingsberger, J. R. Adair- Macmillan.
2. Welding Technology by Rossi- Mc Graw Hill Publications.
3. Welding Handbook, Eighth Edition, Vol. 1 & 2- American Welding Society.

ME-315C AIRCRAFT ENGINE OPERATION & MAINTENANCE (DSE - I)

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3	Sessional:	25 Marks
L T P Total	Theory:	75 Marks
3 0 0 3	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre- Requisite: Thermodynamics, Fluid Mechanics

Successive: Project

Course Objectives:

To understand the principles of operation of aircraft power plant, general familiarization of aircraft engine systems, maintenance procedures and standard practices.

Course Outcomes (COs):

CO 1- Exploring principles of flight and the basic thermodynamics involved.

CO 2- Application of fundamentals of the propulsion system in an aircraft.

CO 3- Expedite Design and working of an aircraft engine.

CO 4- Understanding standard practices and the inspection procedures of the aircraft operation.

Syllabus:

UNIT I Principles of Flight: History of flight, aircraft configuration and its control, basics of aerodynamics.

UNIT II Thermodynamics: First law of thermodynamics, Second law of thermodynamics and Air standard cycles (Brayton Cycle).

UNIT III Propulsion: Fundamentals of gas turbine engines-thrust equation, factors effecting thrust, effect of pressure, velocity and temperature changes through the compressor, characteristics of turbo-prop, turbo fan and turbo jet, classification and types of compressors- centrifugal and axial compressor characteristics, classification of combustion chambers and its performance, convergent/divergent nozzles, classification of turbines, its operation.

UNIT IV Engine Systems: Overview of engine construction, fuel system, lubrication system, compressor air flow control system, turbine vanes and blade cooling, Full

authority digital electronic engine control, Thrust Reversers, Engine starting and Ignition, Fire protection system, Engine Inlet cowling anti icing, environmental control system and engine indicating system.

UNIT V Standard Practices and Special Inspection Procedures: Standard practices used in aero engine maintenance, introduction to engine overhaul, overview of Bore scope inspection procedures, and introduction to geared turbo fan engines

References:

1. Kermode, A.C. Flight without formulae, Pearson Education; 11th edition, 2011
2. Anderson, J.D. Introduction to flights, McGraw-Hill 8th edition 2015
3. Engineering Thermodynamics- P K Nag, Tata McGraw Hill
4. Thermodynamics: An Engineering Approach- Cengel and Boles, McGraw Hill Company
5. Hill P.G & Peterson, C.R. "Mechanics & Thermodynamics of propulsion" Pearson education (2009)
6. United Technologies' Pratt & Whitney, "The Aircraft Gas Turbine Engine and its Operation
7. Kroes & Wild, "Aircraft Power Plants", 7th Edition- McGraw Hill, New York, 1994
8. Mekinley, J.L and R.D. Bent, Aircraft Power Plants, McGraw Hill 1993
9. Teager, S, "Aircraft Gas Turbine Technology, McGraw Hill 1997.
10. Aviation Maintenance Technician Hand Book- Power Plant Volume -2 FAA-H-8083-32

ME-317C METALLURGY (DSE -I)

B. Tech (Mechanical Engineering) V Semester

No. of Credits: 3	Sessional:	25 Marks
L T P Total	Theory:	75 Marks
3 0 0 3	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre- Requisite: Material Science, Manufacturing Processes

Successive: Tool Design

Course Objectives:

To study various concepts of transformation in metals. To study heat treatment and case carburizing process, non destructive testing of metals, failure analysis, phase diagrams and cooling curves.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Knowledge of types of solid solution and phase diagram.

CO 2- Develop utility and applications of metallography.

CO 3- Understanding the mechanism of fracture.

CO 4- Learn heat treatment process and various factors affecting the heat treatment process.

Syllabus:

UNIT I Solid Solutions: Types of Solid Solutions, Substitutional Solid Solution, Disordered Substitutional Solid Solution, Ordered Substitutional Solid Solution, Interstitial Solid Solution, Hume Rothery's Rules

UNIT II Phase Diagrams: Systems, Phases and Structural Constituents, Cooling Curves, Phase Diagrams, Interpretation of Phase Diagrams, Gibb's Phase Rule, Classification of Equilibrium Diagrams, Two Metals Completely Soluble in Liquid and Solid State, Peritectic Reaction, Eutectoid Transformation, Peritectoid Transformation

UNIT III Iron - Carbon System: Iron, Allotropy, Micro-constituents of Iron and Steel, Iron - Carbon Equilibrium Diagram, Effect of Alloying Elements on the Properties of Steels, Pearlite Transformation, T.T.T. Diagram, Martensite Transformation, Austenite Grain Size and Grain Size Control

UNIT IV Metallography: Introduction and Definition, Metallurgical Microscope, Preparation of Specimen, Micro and Macro Examination, Electron Microscope

UNIT V Heat Treatment Processes: Classification of Heat Treatment Processes, Purpose of Heat Treatment, Principles of Heat Treatment, Annealing-Definition, Purpose and Concepts of (a) Stress Relieving (b) Process Annealing (c) Spheroidising and Full Annealing.

UNIT VI Case Hardening and Surface Treatment: Carburizing, Pack Carburizing, Gas Carburizing, Nitriding, Cyaniding, Flame Hardening, Induction Hardening

Text Books:

1. Elements of Physical Metallurgy – Albert G. Guy – Addison Wesley
2. Metallurgy for Engineers - Rollason – Edward Arnold Publishers
3. Mechanical Metallurgy – Dieter – McGraw Hill
4. Physical Metallurgy for Engineers – Clark – Eastern Western Publishers
5. Elements of Material Science - Vlack - Addison Wesley
6. Engineering Physical Metallurgy - Lakhtin – CBS Publications

ME-310C INDUSTRIAL MANAGEMENT (DSE - II)

B.Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Industrial Engineering, Principles of Management

Successive: Advanced Manufacturing System

Course Objectives:

To familiarize the students with the various aspects of management. To recognize organization structure, financial, wages and relation issues in industries and major provisions of factory acts.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO1-** Understand given organization structure.
- CO2-** Describe the financial aspects related to business.
- CO3-** Explain various aspects of management.
- CO4-** Knowledge of various methods of job evaluation and merit rating.
- CO5-** Describe the various factors affecting industrial relations.
- CO6-** Illustrate the various concepts related to entrepreneurship.

Syllabus:

UNIT I Introduction: Concept of organizational structure, types of organizational structure, types of business organization, Definition and concept of personnel management, aims & objectives of personnel management, functions of personnel management.

UNIT II Aspects in Management: Classical management approach: Frederick Winslow Taylor's scientific management, Henri Fayol's administrative management, Max Weber's Bureaucratic management, Social systems approach, Quantitative approach to management, Qualities of leadership and leadership styles, theories of motivation: Maslow's hierarchy of needs theory, Herzberg's Motivator-Hygiene Theory, Theory X and Theory Y.

UNIT III Financial Aspects Related to Business: Introduction to financial management, functions of financial management, meaning and uses of management accounting,

elements of cost, meaning and factors of depreciation, classification of depreciation problems, factors responsible for the replacement of equipment, replacement analysis and its methods.

UNIT IV Job Evaluation and Merit Rating: Meaning of Job evaluation, job evaluation methods, quantitative and non-quantitative methods of job evaluation, merit rating, selection of factors in setting up merit rating method, methods of merit rating.

UNIT V Wages and Incentives: Meaning of wages, wage classification, system of wage payment, Incentives and its types, time-based individual incentive plans, output based individual incentive plans.

UNIT VI Industrial Relations: Industrial disputes and its results, methods of settling industrial disputes, Industrial accidents, Effects and causes of accidents, meaning and classification of industrial legislations, Factories act 1948, worker's compensation act 1923, Industrial dispute act 1947.

Text Books:

1. Industrial engineering and Management – O.P. Khanna, Dhanpat Rai Publications
2. Industrial Engineering and Management –V. Ravi, PHI publications

Reference Books:

1. Operations Management - Schroeder, McGraw Hill ISE
2. Production & Operations Management - Martinich, John Wiely SE.

ME-312C APPLIED THERMODYNAMICS (DSE - II)

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3	Sessional:	25 Marks
L T P Total	Theory :	75 Marks
3 0 0 3	Total:	100Marks
	Duration of Exam:	3 Hours

Pre- Requisite: Thermodynamics

Successive: Thermal System Design, Power Plant Engineering

Course Objectives:

To understand essential concepts of flow of steam through nozzles, steam boilers, steam turbines and energy conversion. To learn about the concept and different components of vapour power cycles and find the related efficiencies.

Course Outcome (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the concept of vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
- CO 2-** Learn about steam boilers, their types and components.
- CO 3-** Learn about the fundamentals of flow of steam through a nozzle.
- CO 4-** Knowledge of working and types of steam turbines and can calculate their workdone and efficiencies.
- CO 5-** Understand the concepts, types and working of condensers and compressors and define their different types of efficiencies.

Syllabus:

UNIT I Steam Boilers and Draft: Classification, comparison between fire and water tube boilers, Essentials of a good boiler. Constructional and operational details Cochran and Babcock and Wilcox Boiler. Study of high pressure boilers- Benson, Lamont, Loeffler and Velox boilers, Boiler mountings and accessories, Boiler performance, Natural & Artificial drafts, Chimney height, Maximum draft and chimney efficiency, Boiler heat balance sheet, Problems.

UNIT II Vapour Power Cycles: Carnot and Rankine vapour cycles, effect of operating conditions on thermal efficiency of Rankine cycle, Rankine cycle with superheat, reheat and regeneration, Binary vapour cycle, Problems.

UNIT III Flow Through Nozzles: Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow, design pressure ratio, Problems.

UNIT IV Steam Turbines: Classification, Impulse Turbine- Flow through blades, velocity diagram, power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine. Reaction Turbine- Flow through impulse reaction blades, degree of reaction, velocity diagram, power output, efficiency and blade height, comparison of impulse and impulse reaction turbines. Losses in steam turbines, stage efficiency, overall efficiency and reheat factor. Governing of steam turbines, Problems.

UNIT V Steam Condensers: Elements of a condensing plant, types of condensers, comparison of jet and surface condensers. Condenser vacuum, sources of air leakage & its disadvantages, vacuum efficiency and condenser efficiency, Problems.

UNIT VI Air Compressors: Working of a single stage reciprocating air compressor; calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor with Inter-cooling; Perfect Inter cooling; Optimum intercooler pressure. Problems.

Text Books:

1. Thermal Engineering - R.K.Rajput, Lakshmi Publishers
2. Thermal Engineering – P L Ballaney, Khanna Publishers
3. Thermodynamics and Heat Engines vol. II – R Yadav, Central Publishing House

Reference Books:

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd.

Web Links:

NPTEL Video Lecture ,Web: <http://nptel.ac.in>

ME-314C TOOL DESIGN (DSE- II)

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Machine Design

Successive: Project

Course Objectives:

The main objective of this course is to design different tools used in the industries for metal cutting, metal forming, work piece holding and inspection purposes.

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

- CO1-** Select and use different cutting tools and their materials according to machining operations and work piece materials.
- CO 2-** Select the material and design different gauges.
- CO 3-** Design jigs and fixtures for conventional and NC machining.
- CO 4-** Understand the concepts of press tools.
- CO 5-** Design single point and multipoint cutting tools

Syllabus:

UNIT I Tool Geometry, Tool & Work Piece Material: Common work and Tool materials, Tool inserts, Specifications of inserts and tool holders, Physical principle in metal cutting: Chip formation and types of chips, work done in cutting, BUE on metal cutting, curling & contraction of chip , work hardening, quality of machines surfaces.

UNIT II Basic Principles of Tool Design: Tool design – An overview, signature of single point tools, Design of single point turning tool, ISO tool shapes, design of flat and circular form tools, milling cutter.

UNIT III Introduction to Jigs and fixtures, Work holding devices: Basic principle of six point location, Locating methods and devices, Principle of clamping and Types of clamps, Design of jigs: Type of Drill bushes, Classification of drill jigs, Design of drill jigs, Design of fixtures: Design of milling fixtures.

UNIT IV Press Working Operations: Types of Presses, Tonnage required, Blanking Tool and parts, Piercing Tool, Progressive Tool and parts, strip layout, scrap calculation for Blanking and Piercing operations .

UNIT V Brief introduction of CNC machines work holding devices: Tool design for CNC machines, Fixture design for CNC Machine, Cutting tools for CNC Machine, Tool holding methods for CNC Machine, ATC and APC for CNC Machine, Tool presetting for CNC Machine.

UNIT VI Gauges and Gauge Design: introduction, elements and their function, Design of Plug Gauges and Ring Gauges, Standards, materials for gauges, maintenance and safety of gauges.

Text Books:

1. Fundamentals of Tool Design – Donaldson – TMH
2. Theory of Metal Cutting and Tool Design – Arshinov – Mir Publishers, Moscow

Reference Books:

1. Fundamentals of Tool Design- ASTME
2. Tool Design- H.W, Pollack – Tarapoueva
3. Jigs and fixtures - P. H. Joshi – McGraw Hill
4. An introduction to Jigs and Fixtures- M.HA Kempster – Whitaker & Sons Ltd.
5. Fundamentals of Tool Design, F.W.Wilson, ASME, PHI, New Delhi

ME-316C AUTOMOBILE ENGINEERING (DSE - II)

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Kinematics of Machines, Dynamics of Machines

Successive: None

Course Objectives:

To study function of various components in automotive vehicles and safety consideration in vehicles. To study clutches, power suspension, brakes, drive lines, universal joints, steering system, construction and working of hybrid vehicles.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the principle of automobiles drive and advances in automobiles.

CO 2- Explore the concept of various types of clutch.

CO 3- Learn about various types of steering system along with merits and demerits.

CO 4- Knowledge of the various type of hybrid vehicles.

CO 5- Development and understanding of hydrogen based technology for pollution control.

Syllabus:

UNIT I Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

UNIT II Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch; Clutch Linkages.

UNIT III Power Transmission : Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic

Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases.

UNIT IV Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

UNIT V Suspension Systems: Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

UNIT VI Steering System : Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toe-in/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering.

UNIT VII Automotive Brakes, Tyres & Wheels : Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes.

UNIT VIII Hybrid Automotive Vehicles: Introduction to Hybrid Vehicle, Construction and working of hybrid vehicles, working of fuel cell vehicle, vehicular fuel cell system: fuel cell stack, fuel cell engine auxiliaries, electric drive system; benefits of hybrid vehicles, fuel supply, storage and processing in fuel cells.

Text Books:

1. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.
3. Automobile Engineering by D.S.Kumar, S.K.Kataria and Sons, New Delhi

ME-318C DESIGN OF THERMAL SYSTEMS (DSE – II)

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: Non Conventional Energy Resource Utilization

Course Objectives:

To understand various types of thermal and air-conditioning processes. To study heat load estimation, design for air-conditioning building , heat exchangers design and psychometric process.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1- Understand the heat load estimation of air-conditioning system.
- CO 2- General procedure of heat exchanger design in air-conditioning systems.
- CO 3- Complete analysis of vapor compression refrigeration system.
- CO 4- Environmental consideration in design of thermal systems.
- CO 5- Knowledge of thermodynamics of the refrigeration systems.
- CO 6- Design of thermal systems.

Syllabus:

UNIT I Psychrometry of Air Conditioning Processes: Design Conditions & Load Calculations Psychrometric Processes in Air Conditioning Equipments, Analysis of Air Conditioning systems for summer & winter conditions, Inside & out side design conditions for comfort, Industrial Air Conditioning. Cooling & Heating Load calculations- Heat transfer through building structures, solar heat gain, Infiltration & ventilation air, Internal heat gain, Occupancy & Product load, Room sensible heat factor, Effective sensible heat factor & Grand sensible heat factor, capacity of the plant. Design & Selection of Air conditioning Apparatus Heat & moisture transfer in Air conditioning apparatus, Enthalpy potential, Analysis of Coil & Spray Equipments, Design of Cooling & Dehumidifying coils, Design of Air Washer & Cooling Towers.

UNIT II Analysis of Complete Vapour Compression System: Design and

Balancing of System Components, Type of Refrigerant Compressors, Condensers, Evaporators & Expansion devices used in Vapour Compression Refrigeration Cycles, Design and Selection of individual components and their performance characteristics, Use of P-H charts for different Refrigerants in performance predication of the cycle. Analysis of the complete vapour-compression system and determination of 'Balance Points' using Graphical and Analytical methods, system simulation. Layout & selection of Refrigerant, water and Brine pipings for the designed system. Selection of Refrigeration and Air conditioning Controls for the system.

UNIT III Design of Turbomachines: Principles of Design of turbo machines, Design of axial flow turbine stage, Design of axial flow compressor stage, Design of centrifugal compressor.

UNIT IV Design of Heat Exchanger : Study of design aspects, fluid flow and heat transfer characteristics, Material requirement of heat exchange equipments, Liquid - to liquid and Liquid - to - gas heat exchange systems, Familiarity with use of design related standards and codes, Design of Heat exchanger.

UNIT V Optimization of Design of Thermal Systems: like condenser, evaporator, cooling tower for minimum cost and maximum performance, Development of computer program for design, Environmental consideration in design of thermal systems, Analysis of thermal systems using FEM.

Reference Books:

1. Refrigeration & Air Conditioning - by C.P. Arora - TMH
2. Refrigeration & Air Conditioning - by Manohar Prasad – New Age International.
3. Principles of Refrigeration (S.I. Units) - by Roy J.Dossat - AWL.
4. Air Conditioning Engineering - by W,P.Jones - Butterworth.
5. Heating, Ventilating and Air Conditioning - by Mc Quiston, Parker & Spitler - John Wiley Publishing Co.
6. Refrigeration & Air Conditioning Data Book - Manohar Prasad – New Age International
7. Ashrae Hand Book - Fundamentals
8. Refrigeration & Air Conditioning-Stoecker & Jones - Wiley
9. Refrigeration & Air Conditioning - by P.L.Ballaney - Khanna Publishers.

ME-404C MECHATRONICS (DSE - III)
B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Kinematics of Machines, Elements of Electronic Engineering

Successive: Advanced Manufacturing System

Course Objectives:

The main objective of this course is to understand the concept and interfacing of various hardware in mechatronics design of mechanical products and to study control system for effective functioning of mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.

Course Outcome (COs): At the end of the course, the student shall be able to:

- CO 1-** Generate conceptual design for Mechatronics products based on potential custom requirements.
- CO 2-** Select appropriate sensors and actuators.
- CO 3-** Design a control system for effective functioning of Mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.
- CO 4-** Develop system model for mechanical system.
- CO 5-** Understand hardware tools to build mechatronics system.

Syllabus:

UNIT I Introduction and Basics: Introduction, Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers; The Mechatronic Approach.

Hardware of Measurement Systems; A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / along with Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier; Protection; Filtering; Wheat Stone Bridge; Digital Signals; Multiplexers; Data Acquisition; Digital Signal Processing; Pulse Modulation; Data Presentation Systems – Displays; Data Presentation

Elements; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems.

UNIT II Pneumatic, Hydraulic, Mechanical and Electrical Actuation Systems: Pneumatic and Hydraulic Systems; Directional Control Valves; Valve Symbols; Pressure Control Valves; Cylinder Sequencing; Process Control Valves; Rotary Actuators; Mechanical Systems – Types of Motion, Kinematic Chains, Cams, Gear Trains, Ratchet & Pawl, Belt & Chain Drives, Bearings, Mechanical Aspect of Motor Selection; Electrical Systems; Mechanical & Solid State Switches; Solenoids; D.C. & A.C. Motors; Stepper Motors; Problems.

UNIT III System Modeling and Performance: Engineering Systems; Rotational – Translational Systems; Electro-mechanical Systems; Hydraulic – Mechanical Systems; A review of modeling of First and Second Order Systems and Performance Measures; Transfer Functions for first order System, Second Order System, Systems in series & Systems with Feedback Loops; Frequency Response of First Order and Second Order Systems; Bode Plots: Performance Specifications: Stability; Problems.

UNIT IV Closed Loop Controllers: Continuous and Discrete Processes – Lag, Steady State Error; Control Modes; Two- step Mode; Proportional Mode – Electronic Proportional Controllers; Derivative Control – Proportional plus Derivative Control; Integral Control - Proportional plus Integral Control; PID Controller – Operational Amplifier PID Circuits; Digital Controllers – Implementing Control Modes; Control System Performance; Controller Tuning – Process Reaction Method & Ultimate Cycle Method; Velocity Control; Adaptive Control; Problems.

UNIT V Digital Logic and Programmable Logic Controllers : A Review of Number Systems & Logic Gates; Boolean Algebra; Karnaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems.

UNIT VI Microprocessors and Input/ Output Systems: Control; Microcomputer Structure; Micro- controllers; Applications; Programming Languages; Instruction Sets; Assembly Language Programs; Subroutines; Why C Language ? A review of Program Structure, Branches, Loops, Arrays, Pointer; Examples of Programs; Interfacing; Input/ Output; Interface Requirements; Peripheral Interface Adaptors; Serial Communication Interface; Examples of Interfacing; Problems.

Design and Mechatronics: Design Process; Traditional and Mechatronics Design; Possible Mechatronics design solutions for Timed Switch, Wind Screen Wiper Motion, Bath Room Scale, A Pick & Place Robot, Automatic Camera, Engine Management System & Bar Code Recorder.

Text Books:

1. Mechatronics by W. Bolton, Published by Addison Wesley.
2. Mechatronics System Design – Devdas Shetty and Richard A. Kolx Brooks/ Cole 1997.

Reference Books:

1. Introduction to Mechatronics and Measuring System: david G. Alciation and Michael B. Hits and Tata McGraw Hill
2. Mechatronics – Sensing to Implementation - C.R.Venkataraman, Sapna

ME-406C PRODUCTION PLANNING AND CONTROL (DSE - III)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Industrial Engineering

Successive: None

Course Objectives:

To know about the different types of production systems. Able to apply the aggregate planning strategies and scheduling techniques with respect to production systems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand production systems and their characteristics.

CO 2- Evaluate MRP and JIT systems against traditional inventory control systems.

CO 3- Understand basics of variability and its role in the performance of a production system.

CO 4- Analyze aggregate planning strategies.

CO 5- Apply forecasting and scheduling techniques to production systems.

CO 6- Knowledge of theory of constraints for effective management of production systems.

Syllabus:

UNIT I Introduction to Production Systems: Production Systems: Classification & Characterization, Overview of Production Planning and Control issues, Review of EOQ & inventory control systems.

UNIT II Just in Time Production Systems: Just-in-Time System: Evolution, Characteristics of JIT Systems, Continuous Improvement, The Kanban System, Strategic Implications of JIT System.

UNIT III Material Requirement Planning: Dependent Demand & Material Requirement Planning, Structure of MRP system, MRP Calculations, Planning Issues, Implementation Issues.

UNIT IV Factory Physics: Basic factory dynamics, Variability basics, Push and pull production systems, Lean manufacturing.

UNIT V Aggregate Planning: Aggregate Planning: Purpose & Methods, Reactive and Aggressive Alternatives, Planning Strategies, Master Production Scheduling.

UNIT VI Issues in PPC: New developments in Planning & Control of Product-focused Systems and Process-focused Systems, Theory of Constraints.

Text Books:

1. Production & Operations Management – Chary, TMH, New Delhi.
2. Modern Production Management – S.S. Buffa, Pub. John Wiley.

Reference Books:

1. Krajewski L.J. and Ritzmen L.P., Operations Management: Strategy and Analysis, 9th Edition, Pearson Education, 2010.
2. Chase, R.B., Jacobs, F.R. and Aquilano, N.J., Operations Management for Competitive Advantage, 11th Edition, Tata McGraw Hill Book Company, New Delhi, 2010.
3. Hopp, WJ and Spearman, ML, Factory Physics: Foundations of Manufacturing Management, McGraw Hill International Edition, Third Edition, 2008.

ME-408C INDUSTRIAL CONTROLS (DSE – III)

B.Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Elements of Electronics Engineering, CAM and Automation

Successive: None

Course Objectives:

To study essential concepts of various types of automation, sensors and actuators. To study automated material handling system. To study various types of programmable logic controllers.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand about programmable logic controllers.
- CO 2-** Complete understanding about communication networks for automation.
- CO 3-** Expedite the role of human factors in a project.
- CO 4-** Knowledge of various types of sensors and actuators for various applications.
- CO 5-** Exploration of flexible manufacturing system for making variety of components.

Syllabus:

UNIT I Introduction: Meaning and need of automation, Types of automation: fixed, programmable, flexible, and integrated automation.

UNIT II Components of Automation: Actuators, controllers, sensors. Actuators; Solenoids and torque motors, Hydraulic and pneumatic actuators, valves and circuits. Sensors; characteristics, contact and non-contact type, Pressure switches, proximity and position sensors. Encoders, resolvers, synchros. Vision systems; Components of vision systems, image, camera, image capturing systems. Processing systems Bar coding and other identification systems. Controllers; Digital and analog control, open and closed loop control, servosystems, servosystem analysis and response, control configuration

UNIT III Logic Control and PLCs: Logic control, logic control elements, Programmable logic controllers: Applications, architecture, operation, and programming of PLCs. Typical applications.

UNIT IV Automated Material Handling Systems: Automated flowlines, transfer mechanisms, conveyors, robots, Automated guided vehicles; categories, guiding technologies and control. Automated Storage and Retrieval Systems, categories and components.

UNIT V Automated Inspection Systems: In process gauging systems, Co-ordinate measuring machines: Construction, operational modes and different probes.

Factory communication: interface standards, communication networks, LAN, WAN, Protocols: OSI and MAP.

UNIT VI Flexible Manufacturing Systems: Types, components, architecture and control. Computer integrated manufacturing.

Text Books:

1. Groover Mikell “Automated Production Systems, and Computer Integrate Manufacturing” / PHI, 1992
2. Morriss, S. Brian, “Automated Manufacturing Systems”, Glanncoe Mcgra, International Series, 1995.

ME-410C MACHINE TOOL TECHNOLOGY (DSE- III)

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Machine Design

Successive: Project

Course Objectives:

Study of machine tools, its functions, installation of machine tools, principles of machine tool design, installation of machine tools, testing of machine tools, repair and maintenance of machine tools.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Understand principles and applications of oxyacetylene and electric arc welding.

CO 2- Knowledge of various types of welds testing.

CO 3- Learns concept and techniques of welding automation.

CO 4- Analyse methods of advanced and special welding processes.

CO 5- familiarisation of computer system and software for welding engineers.

Syllabus:

UNIT I Principles of Machine Tool Design: Machine Tool and its functions, classification of Machine Tools, elements of Machine Tools, Machine bed-functions, material, cast v/s welded structures, slides and slideways- functions, material, types, spindles and bearings- functions, materials, plain and roller bearing. Types of drives for Machine Tools-mechanical, electrical, hydraulic and pneumatic, stepped and stepless drives, system of change gears, sliding gears, clutch drives, Norton gear, layout of spindle speeds, speed values in A.P. and G.P., Logrithmic Progressions, layout of gear boxes, variators, face plate and cone Type.

UNIT II Automatics: Introduction to automatics, basic concepts of automatic machine tools, operating cycles, particular cycles of the operative numbers, cam controlled automatics, cam and their types, cam layout, automatic lathes- Introduction, work

feeding, tool feeding, classification of automatic lathes, single spindle chucking automatics, automatic screw machines, automatic work feeding devices

UNIT III Pneumatics and Hydraulics in Machine Tools: Hydraulic system, gear pump, variable delivery vane pump, plunger pump, principles of operation of single and double acting cylinders, hydraulic motor, control valve and relay valve. Pneumatic drives in machine tools, pneumatic control circuits and their response analysis.

UNIT IV Installation of Machine Tools: Location, lifting and unloading of machines, Equipments such as pulley blocks, Gantry, Derricks, Shear legs, Rollers and pinch bars. Slings of shaper, milling machine. Lathe, precaution in loading and unloading. Foundation for machine tools. Types of Foundations, Foundation plans for lathe and milling machines, Erection and Levelling, Grouting.

UNIT V Testing of Machine Tools: Factors affecting performance of machine tools, Machine tool-workpiece-Fixture systems, Reasons for errors in machining. Geometrical/Alignment Tests, Performance tests, Testing Equipments, Dial Gauges, Mandrel, Spirit Level, Straight Edges, Auto Collimator, Test charts, Testing of Lathes, Vertical Milling Machines, Radial Milling machines and Shaper, Introduction to Modern Testing Equipments (DIGITAL/ ANALOGUES).

UNIT VI Repair and Maintenance of Machine Tools: Types of Maintenance, Break Down and Preventive Maintenance, Organization of Maintenance Department, Economic aspects of Preventive Maintenance, Restoration Techniques, Scraping, Babbiting, Use of Plastic Compound, Weld Deposition, Metalising.

Text Books:

1. Principles of Machine Tools – G.C. Sen & A. Bhattacharya, Tata McGraw Hill, New Delhi
2. Production Engineering by P.C. Sharma – S. Chand & Co

Reference Books:

1. Production Technology by R.K. Jain - Khanna Publishers
2. Industrial Maintenance by H.P. Garg – S. Chand and Company

ME-412C ESTIMATION AND DESIGN OF RAC PLANTS (DSE - III)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: None

Course Objectives:

To study various types of air-conditioning design and ducting. To study heat load estimation and design for air-conditioning building. To study cold storage and ice making requirements of system.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the heat load estimation of air-conditioning system.
- CO 2-** Knowledge of general procedure of piping design in air-conditioning systems.
- CO 3-** Analyse cold storage system and ice making requirements of system.
- CO 4-** Learn air space ducting and duct design in air-conditioning system.
- CO 5-** Design and development refrigeration system
- CO 6-** Develop refrigeration system improvement.

Syllabus:

UNIT I Load Estimation: Building Survey and Heat Load Estimation, design conditions, solar radiations, Heat Gain through Walls, Roofs and Glasses, Load from Partitions, Ceilings and Floors, Load from outdoor Air, Ventilation and Infiltration, Effect of outdoor Air on Load, Heat Sources within Conditioned Space, Miscellaneous Heat Sources, Minimum entering Air Temperature, Load Estimating forms, Examples, Cooling Load calculations of Restaurant, Office Building, Auditorium. Heat Load calculation, Design Conditions, General Procedure Design for outdoor Weather conditions, Transmission Heat Loss, Heat Load Estimation forms, Modification of Cooling Load for Year Round Air Conditioning.

UNIT II Space Air Distribution: Definition, Standard for satisfactory conditions, Principles of Air Distribution, Blow, Drop, Spread, Induction, Types of Outlets, Performance of Outlets, Outlet Location and Selection, Layout for Air Distribution, Directional and Volume Control, Return and Exhaust Intakes, Air Distribution for Refrigerated Space, Ventilation Requirement, Outside and Inside Design Conditions.

UNIT III Air Duct Design: Pressure changes, Friction Losses, Continuity Equation, Darcy Formula, Circular equivalent of Rectangular Ducts, Dynamic Losses, Pressure Losses in Elbows and Divided flow, Losses due to Area changes, Duct designing methods, Sizing Procedure, Equal Friction Method, Static Regain Method, Construction details, Heat Losses from Ducts.

UNIT IV Piping Design: General Procedure for Piping Design, Refrigerant piping, Design Considerations, Piping of Suction Line, Liquid Refrigerant Line, Discharge Line, Steam and Water Piping Design.

UNIT V Automatic Ice Makers: Cube ice, Flaked and Compressed Ice, Machine Performance, Characteristics of Clear Chip, Clear Cube, Clear Flake machines, General idea of System Design, Water Treatment of Ice Making, Common Defects of Ice and their Remedies.

UNIT VI Design of Cold Storage: Introduction, Causes of food spoilage, Factors contributing to food spoilage, Control measure to be taken to prevent spoilage of food, Cold Storage Practices, Effect of Low Temperature on Milk, Eggs, Methods of Preservation, Slow Freezing, Quick Freezing, Effect of Humidity, Storage Temperature, Relative Humidity and Air Motion, Estimation of Load, Load Calculations, Number of Air Changes, Calculations for Cold Storages, Capacity, Numericals.

Text Books:

1. Carrier HandBook for HVAC Engineers.
2. ISHRAE HandBook for HVAC Engineers
3. HVAC System Design Practices - McQuisten – John Wiley & Sons.
4. Refrigeration and AirConditioning- Manohar Prasad – New Age International.
5. Refrigeration and AirConditioning- C.P.Arora – TMH.

ME-414C FLEXIBLE MANUFACTURING SYSTEM (DSE- IV)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Industrial Engineering, Manufacturing Technology and Automation

Successive: None

Course Objectives:

To understand the design, planning and operational concepts of FMS and learn about the different tools and techniques for analyzing the same.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand FMS and job-shop and mass production manufacturing systems.
- CO 2-** Knowledge of concept and design of flexible manufacturing cells.
- CO 3-** Explore processing stations and material handling systems used in FMS environments.
- CO 4-** Analyze the production management problems in planning, loading, scheduling, tool management and breakdown in a typical FMS.
- CO 5-** Design and analyze FMS using analytical techniques.

Syllabus:

UNIT I Understanding of FMS: Evolution and classifications of Manufacturing Systems, Definition, Objective and Need, Components, Merits, Demerits and Applications of FMS.

UNIT II Flexible Manufacturing Cell: Part families, parts classification and coding, types of classification and coding systems. Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement.

UNIT III FMS Processing Stations: Machining Centers, Turning centers, CMM, Washing/ Deburring station, etc. Different Layouts and their Salient features.

UNIT IV Material Handling Systems: An introduction, Conveyor, AGV, ASRS, Robots, etc. and their salient features.

UNIT V Management Technology: Tool Management, Configuration planning and routing, Production Planning and Control, Scheduling and control, Computer Networks and Control.

UNIT VI Design of FMS: Performance Evaluation, Analytical models of FMS, Case studies: Typical FMS problems from researches papers.

Text Books:

1. Groover, M.P. "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009

Reference Books:

1. Tempelmeier, H. and Kuhn, H. "Flexible Manufacturing system: Decision support for design and operation", John Wiley and Sons 2003.

2. Maleki A. "Flexible Manufacturing Systems: the technology and management". Prentice Hall International –2009

ME-416C PROJECT MANAGEMENT (DSE - IV)

B.Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Operation Research

Successive: None

Course Objectives:

To develop project within time, resource & budget, types of projects, project life cycle and decisions. To align project execution with strategies. To identify project issues clearly and come up with new solutions.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Illustrate the types of projects and project appraisal & selection.

CO 2- Describe and develop project network.

CO 3- Knowledge of the role of human factors in a project.

CO 4- Develop and solve Project evaluation & review technique (PERT) & Critical path method (CPM).

CO 5- Analyze how to control & monitor a project.

Syllabus:

UNIT I Introduction & Overview: Definitions, Types of projects, Project life cycle (Project phases) and decisions.

UNIT II Go/ No go decisions based on: a) Project Identification and Screening, b) Project Appraisal: Market, Technical, social, Ecological & Financial, c) Project Selection: Pragmatic, pair wise, MADM approach.

UNIT III Development of Project Network: Project description, Work break down structure, Nomenclature, Rules for drawing and representation, consistency and Redundancy in Project Networks, Matrix representation, Basic Scheduling with Networks (Forward & Backward Pass)

UNIT IV CPM & PERT: Activity times, Completion, Floats, Probability (ND usage), Examples, and Problems.

UNIT V Project Monitoring & Control: Project adjustments, Crashing: Direct & Indirect cost, Normal & Crash: duration & cost, Resource leveling: Types, usage, leveling, Problems, Managing Risk.

UNIT VI Role of Human Factors and Project completion: Dealing with people Team Building and Leadership in Projects, commitment, work culture, motivation, coordination, attitude, innovation. Project Completion, Review and Future Directions

Text Books:

1. Project Management: A Life Cycle Approach by Arun Kanda. (PHI Learning)
2. Project Management: Engineering, Technology, and Implementation by Shtub, Bard and Globerson,, PH Inc.

Reference Books:

1. Project Management by Clifford Gray and Erik Larson. (Tata McGraw Hill Edition)
2. Management Guide to PERT/ CPM by Wiest, JD and Levy F.K. (PHI)
3. Industrial Engg. & Mgmt. by Dr Ravi Shankar. Galgotia Publications.

Web Links:

1. https://en.wikipedia.org/wiki/Project_management
2. <http://freevideolectures.com/Course/2371/Project-and-Production-Management/2>
3. https://www.youtube.com/watch?v=DdDzybQ_9vM

ME-418C TRIBOLOGY (DSE - IV)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory : 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Fluid Mechanics

Successive: None

Course Objectives:

The main objective of this course is to study the concepts of friction and wear and to minimize their effects by lubrication on different surfaces.

Course Outcomes (COs): After studying this course the student will be able to:

- CO- 1** Illustration of concept of surfaces & friction.
- CO 2-** Understand about the concept of wear of materials.
- CO 3-** Coceptulisation of lubrication & its types.
- CO 4-** Understand about the Film Lubrication Theory
- CO 5-** Learning of Surface Engineering and Materials for Bearings.

Syllabus:

UNIT I Surfaces and Friction: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction -Adhesion Ploughint- Energy dissipation mechanisms, Friction Characteristics of metals - Friction of non-metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction. Source of Rolling Friction - Stick slip motion - Measurement of Friction.

UNIT II Wear- Types of wear: Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear. Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

UNIT III Lubricants and Lubrication Types: Types and properties of Lubricants - Testing methods - Hydrodynamic Lubrication – Elasto hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication Hydrostatic Lubrication.

UNIT IV Film Lubrication Theory: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation, Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings -Virtual Coefficient of friction - The Somerfield diagram.

UNIT V Surface Engineering and Materials for Bearings: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - 103 Plating and anodizing Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Text/Reference Books:

1. I.M. Hutchings, Tribology, Friction and Wear of Engineering Material, Edward Arnold
2. T.A. Stolarski, Tribology in Machine Design , Industrial Press Inc
3. E. P.Bowden and Tabor.D., Friction and Lubrication , Heinemann Educational Books Ltd
4. A. Cameron, Basic Lubrication theory , Longman, U.K., 1981.
5. M. J.Neale (Editor), Tribology Handbook, Newnes. Butter worth, Heinemann, U.K

ME-420C AIR- CONDITIONING EQUIPMENTS (DSE - IV)

B.Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics, Refrigeration and Air Conditioning

Successive: None

Course Objectives:

To study and understand the concept of different equipments used in Refrigeration & Air Conditioning Systems and their working.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand the construction and working principles of different type of filters, Humidifiers and dehumidifiers and their need.
- CO 2-** Learning working of condenser and cooling tower used in RAC system.
- CO 3-** Concepts of Evaporators.
- CO 4-** Application of compressors used in RAC systems.
- CO 5-** Utilisation of fans and pumps used in RAC systems.
- CO 6-** Understand working of Expansion devices and electric motors used in RAC systems.

Syllabus:

UNIT I Filters: Air Cleaning, Air Filters, Methods of Air Cleaning, Different types of Air Filters, Selection of Air Filters, Performance of air Filters, Odour Removal, Humidifiers: Need of Humidifiers, Methods of Humidification, Various types of Humidifiers, Dehumidifiers: Need of Dehumidifiers, Methods of Dehumidification and Various types of Dehumidifiers.

UNIT II Condensers and Cooling Towers: Types of Cooling Medium and their Selection, Air and Water cooled Condensers, Economic Operation of Condenser, Different Types of Water Cooled Condensers, Spray Ponds, Cooling Towers, Natural, Forced and Induced Draft Cooling Towers, Design Analysis of Cooling Towers, Performance Analysis of Condensers and Cooling Towers.

UNIT III Evaporators: Factors Considered for Design of Evaporators, Evaporator Types: Flooded and Dry Evaporators, Natural and Forced Convection, Shell and Tube, Shell and Coil, Plate type and Secondary Evaporators. Application of Fins, Temperature distribution and Heat flow in Evaporator, Pressure drop, Fouling correction factor, Selection of Evaporators.

UNIT IV Compressors: Reciprocating, Rotary, Scroll, Centrifugal, Screw and Thermo-Compressor Compressors (Excluding the Analysis), Factors Affecting the Performance of Reciprocating Compressor, Capacity Control of Compressors, Compressors for Eco-friendly Refrigerants, Variable Drive Compressor and Future Trends in Refrigeration Compressors and Selection of Compressors, Inverter based technology and variable refrigerant flow system.

UNIT V Fans: Types, Axial Flow Fans, Centrifugal Fans, Total Pressure Developed by Fan, Fan air power and Efficiencies, Problems, Pumps: Types, Reciprocating, Gear or Rotary and Centrifugal Pumps, , Selection of Fans and Pumps.

UNIT VI Expansion Devices: Capillary tube, Automatic Expansion, Thermostatic Expansion, High-Side float, Low-Side Float and Solenoid Control Valves, Electronic expansion valve, Introduction to Electric Motors and their Applications, Variable speed motors, variable frequency drive for motors, Introduction to Motor Starting Relays and Motor Overload Protector.

Text Books:

1. Refrigeration and Air Conditioning by C.P. Arora – TMH.
2. Refrigeration and Air Conditioning by S.C.Domkundwar – Dhanpat Rai & Sons
3. Refrigeration and Air Conditioning by D.S. Kumar- Kataria and Sons

Reference Books:

1. Carrier Hand Book for HVAC Engineers.

ME-422C NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION

(DSE- IV)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory : 75 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: None

Course Objectives:

To study energy resources, energy planning and their utilization. To study various non-conventional energy sources such as bio-gas, solar energy and its utilization, wind energy, etc. To study operating characteristics of fuel cells and tidal energy.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand about the types of energy resources and energy requirement.

CO 2- Complete understanding about production and utility of bio-gas and wind energy.

CO 3- Knowledge of the utility of solar energy.

CO 4- Familiarization of the project evaluation & review technique (PERT) & critical path method (CPM).

CO 5- Understanding tidal and wave energy as alternate resource.

Syllabus:

UNIT I Energy Resources and their Utilization : Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

Solar Radiations: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth

angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.

UNIT II Solar Energy: Solar thermal power and its conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, Solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, Solar pumping, Solar cooking, Greenhouses, Solar power plants.

Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

UNIT III Biogas: Photosynthesis, Bio gas production, Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.

UNIT IV Wind Energy: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development.

UNIT V Tidal Power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy, Limitations of tidal energy conversion systems. Hydrogen Energy: Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.

UNIT VI Thermoelectric Systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. Geothermal energy: Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion.

Ocean Energy: Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC,

Reference Books:

1. Bansal Keemann, Meliss,” Renewable energy sources and conversion technology", Tata McGraw Hill.
2. Kothari D.P., “Renewable energy resources and emerging technologies", Prentice Hall of India Pvt. Ltd.
3. Ashok V. Desai, "Non conventional Energy", New Age International Publishers Ltd.

ME-424C MICRO AND NANO MANUFACTURING (DSE- V)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Material Science, Physics

Successive: None

Course Objectives:

The objective of this course is to familiarize the students with the processes and techniques of micro and nano manufacturing.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO 1-** Understand manufacturing considerations at the micro and nano scale.
- CO 2-** Understand design-and-analysis methods and tools used for micro and nano manufacturing.
- CO 3-** Select manufacturing methods, techniques and process parameters for material processing quality.
- CO 4-** Design and select industrially-viable processes, equipment and manufacturing tools for specific industrial products.

Syllabus:

UNIT I Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology.

Nano materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of nanomaterials- solgel process, Liquid solid reactions; Gas Phase synthesis of nanomaterials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing(GPC), Chemical Vapour Condensation(CVC)- Cold Plasma Methods, Laser ablation, Vapour – liquid –solid growth, particle precipitation aided CVD, summary of Gas Condensation Processing(GPC).

UNIT II Structural Characterization: X-ray diffraction, Small angle X-ray Scattering, Optical Microscope and their description, Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM).

Spectroscopic characterizations: Basic concepts of spectroscopy, operational principle and application for analysis of nanomaterials, UV-VIS-IR Spectrophotometers, Principle of operation and application for band gap measurement, Raman spectroscopy.

UNIT III Surface Characterization: X-ray Photoelectron Spectroscopy (XPS), Auger electron spectroscopy, Low Energy Ion Scattering Spectroscopy (LEISS), Secondary Ion Mass Spectroscopy (SIMS), Rutherford Backscattering Spectroscopy (RBS).

Thermal Characterization of Nanomaterials: DTA, TGA, DSC (Principle and Applications), Determination of thermo physical parameters.

UNIT IV Microfabrication Techniques: Lithography, Thin Film Deposition and Doping, Etching and Substrate Removal, Substrate Bonding. MEMS Fabrication Techniques, Bulk Micromachining, Surface Micromachining, High- Aspect-Ratio Micromachining.

UNIT V Nanofabrication Techniques: E-Beam and Nano-Imprint Fabrication, Epitaxy and Strain Engineering, Scanned Probe Techniques, Self-Assembly and Template Manufacturing.

UNIT VI MEMS Devices and Applications: Pressure sensor, Inertial sensor, Optical MEMS and RF-MEMS, Micro-actuators for dual-stage servo systems.

Text Books:

1. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
2. Gabor L. Hornyak, H.F Tibbals, Joydeep Dutta & John J Moore, Introduction to Nanoscience and Nanotechnology, CRC Press, 2009.

Reference Books:

1. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
2. Robert F Speyer, Thermal Analysis of Materials, Marcel Dekker Inc, New York, 1994.
3. B.D. Cullity - Elements of X-Ray Diffraction, 3rd edition, Prentice Hall , 2002.

ME-426C QUALITY MANAGEMENT (DSE - V)

B.Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Industrial Engineering

Successive: None

Course Objectives:

To understand the concept of Quality Management, Quality related tools and techniques and their use as per industry standards.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the issues and dimensions related to quality management

CO 2- Use of different tools and techniques used for quality management

CO 3- Analyze the sampling process and plans

CO 4- Knowledge of the aspects of quality of national and international bodies.

Syllabus:

UNIT I Introduction: Evolution of Quality Management, Philosophy, Concepts of Product and Service Quality, Dimensions of Quality, Quality Guru's, Quality Awards, Quality Cost.

UNIT II Quality Assurance: Inspection, Quality control, Quality assurance, Concept and Advantage of quality assurance, Quality rating, Quality survey/audit, Vendor rating, Quality function deployment.

UNIT III Process Quality Improvement: Introduction to Process Quality, Graphical and statistical techniques for Process Quality Improvement, Graphical tools for data representation, 7QC tools, Process capability analysis, Measurement system analysis.

UNIT IV Acceptance Sampling: Concept of acceptance sampling, advantage and limitations of sampling inspection, Sampling methods, Operating characteristics curve, producer and consumer risk, Average outgoing quality limits, sampling plans, sampling plans for variables, Problems.

UNIT V Control Charts: Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables - \bar{X} and R charts, attribute control charts - p, np, c and u- Construction and application, Problems.

UNIT VI Contemporary Trends in Quality Engineering & Management: Introduction to Quality Management Standards – ISO : 9000, ISO:14000, Reliability, Quality circles, Concept of Six sigma, Basic steps involve in six sigma, National and International bodies for quality aspects, Introduction to Japanese's quality techniques such as 5S, Kaizen, SMED, TQM,TPM.

Text Books:

1. Quality Management by Kanishka Bedi, Pearson Education
2. Stastical Quality control by Grant and Leavenworth, Tata Mcgraw Hill

Reference Books:

1. Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) by K C Jain and A K Chitale, Khanna Publishers
2. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India
3. Total Quality Management by Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield and Mary Besterfield-Sacre, Pearson Educaiton
4. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.

Web links:

1. <https://www.spseplzen.cz/comenius/uquality%20management%20system%20II.ppt>
2. www.powershow.com/.../ISO_9001_quality_management_system_guide_powerpoint...
3. nptel.ac.in/courses/110101010/

ME-428C DESIGN AND OPTIMIZATION (DSE - V)

B.Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Operation Research

Successive: None

Course Objectives:

The main objective of this course is to introduce the optimisation of design techniques.

Course Outcomes (COs): At the end of this course the student shall be able to:

CO 1- Introduction to design optimization

CO 2- Illustration of different approaches for optimization.

CO 3- Understand about the application optimization in mechanical design.

CO 4- Learning of different optimization techniques.

CO 5- Knowledge of different practical applications of optimization with respect to functionality, aesthetics, economics & materials.

Syllabus:

UNIT I Introduction to Optimum design: Introduction to detail design optimization by simulation, prototyping and optimum. Selection of configuration, materials and processes.

UNIT II Optimization Approach: Classical mathematical methods of optimization. Mechanical System Design problem-economic political environment, issues of human safety & welfare, and professional ethics. Optimum mechanical design concepts.

UNIT III Overview and application of optimization methods to machine elements and mechanical system design. Prototyping, simulation, and use of standards for detail design optimization.

UNIT IV Optimization Techniques: Optimum selection of material & processes in mechanical design using material selection charts and optimization methods.

UNIT V Applications: Optimizing product design functionality, aesthetics and economics by employing industrial design principles and by suitable selection of material & processing including use of polymers, composites and other non-metallic materials.

Text/Reference Books:

1. H. Adeli. Advances in Design Optimization.
2. Robert F. RHYDER, Manufacturing Process Design and Optimization, New York: Marcel Dekker,
3. S.S.Rao, Optimization: Theory & Application Wiley Eastern
4. K. Deb, Optimization for Engineering Design, Prentice Hall India
5. J.S.Arora, Introduction to Optimum Design, McGraw Hill

ME-430C POWER PLANT ENGINEERING (DSE IV)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics, Applied Thermodynamics, Fluid Machines

Successive: None

Course Objectives:

To study various essential concepts of conventional and unconventional power plants. To study nuclear power plants and non-conventional power plant. To study pollution emission and their effect on environment.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the principles of steam power plants and gas power plants.

CO 2- Utility and applications of nuclear power plant.

CO 3- Installation and commissioning of hydro-electric power plants.

CO 4- Knowledge of various factors affecting non-conventional power plant.

CO 5- Learn about different types of power plants

CO 6- Analyse pollution emission and their effect on environment

Syllabus:

UNIT I Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

UNIT II Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

UNIT III Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

UNIT IV Combined Cycles: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal, using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles. Problems.

UNIT V Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

UNIT VI Power Plant Economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-output curves, efficiency, heat rate, economic load sharing, Problems.

UNIT VII Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

UNIT VIII Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

Text Books:

1. Power station Engineering and Economy by Bernhardt G.A. skrotzki and William A. Vopat – Tata Mc Graw Hill Publishing Campany Ltd., New Delhi
2. Power Plant Engineering: P.K. Nag Tata McGraw Hill second Edition 2001

ME-432C ADVANCE MANUFACTURING PROCESSES (DSE- V)

B. Tech (Mechanical Engineering) VIII Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: None

Course Objectives:

The main objective of this course is to get knowledge about non traditional machining process and understand theory involved material removal mechanism.

Course Outcomes (COs): At the end of the course, the student shall be able to:

- CO1-** Acquire knowledge about non traditional machining process.
- CO 2-** Study the different process parameters and differentiate between various non traditional machining processes.
- CO3-** Identify suitable non traditional machining process.
- CO4-** Understand various material removal mechanisms.

Syllabus:

UNIT I Material Removal Processes: Introduction, history of machining, traditional machining processes, non traditional machining processes, hybrid machining processes. need for non-traditional machining processes.

UNIT II Mechanical Processes: Ultrasonic machining - Introduction, the machining system, material removal process, factors affecting material removal rate, dimensional accuracy and surface quality, applications. Water jet machining - Introduction, The machining system, Process parameters, Applications, Advantages and disadvantages of WJM, Abrasive Jet Machining - Introduction, Machining system, Material removal rate, Applications, Advantages and limitations of AJM.

UNIT III Chemical Processes: Chemical Milling - Introduction, Tooling for CHM, Process parameters, Material removal rate, Accuracy and surface finish, Advantages, Limitations, Applications Photochemical Milling - Introduction, Process

description Applications, Advantages Electro Polishing - Introduction, Process parameters, Applications, Process limitations.

UNIT IV Electrochemical Processes: Electro Chemical Machining: Introduction, Principles of electrolysis, Theory of ECM, ECM equipment, Basic working principles, Process characteristics, Process control, Applications Basics of Electrochemical Drilling, Electro-Chemical Deburring, and Electro stream drilling.

UNIT V Hybrid Electrochemical Processes: Electro Chemical Grinding - Introduction, Material removal rate, Accuracy and surface quality, Applications, Advantages and disadvantages Electrochemical Honing - Introduction, Process characteristics, Applications Electrochemical Super Finishing - Introduction, Material removal process, Process accuracy Electrochemical Buffing - Introduction, Material removal process.

UNIT VI Thermal Processes: Introduction, Mechanism of material removal, The machining system, Material removal rates, Heat-affected zone, Applications. Wire EDM/Surface EDM principle, Process parameters, surface finish and machining accuracy, applications. Laser beam machining - Introduction, material removal mechanism, applications, advantages and limitations. Electron beam machining - introduction, basic equipment and removal mechanism, applications, advantages and disadvantages. Plasma beam machining - introduction, machining systems, material removal rate, accuracy and surface quality, applications, advantages and disadvantages. Ion beam machining - introduction, material removal rate, accuracy and surface effects, applications.

Text Books:

1. Pandey P.C. and Shah H.S, “Modern Machining Processes”, TMH.
2. El-Hofy, Hassan Abdel-Gawad, “Advanced Machining Processes: Non traditional and Hybrid Machining Processes”, McGraw-Hill.

References:

1. Bhattacharya A, “New Technology, the Institution of Engineers”, India
2. V. K. Jain, “Advanced Machining Processes”, Allied Publishers.

The Syllabus for General Elective Courses offered by CE and IT Department:

GC-101C INTELLIGENT SYSTEMS

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

UNIT I Fundamental Issues in IS : Definition of AI , History ,Domains AI ,AI problems & State space ,Some examples problems representations like Travelling Salespersons, Syntax analysis Problem. Basic issues to solve AI problems, Underlying assumptions, AI techniques, Level of model ,Criteria for success , Control strategies, DFS, BFS

UNIT II Heuristic Search Techniques: Generate & Test, Hill Climbing (simple & stipest), Best first search, A*, AO*, Constraint Satisfaction.

UNIT III Knowledge Representation Issues: Syntax & Semantic for Propositional logic, Syntax & Semantic for FOPL, Properties for WFF's, Resolution Basics : conversion to clausal form ,Resolution of proposition logic, Resolution algorithms for predicates, Problems with FOPL ,Semantic nets ,Frames ,Scripts

UNIT IV Reasoning Under Uncertainty: An introduction, Default reasoning & Closed world assumptions, Model & Temporal logic ,Fuzzy logic, Basian Probabilistic inference Dempster Shafer theory ,Heuristic reasoning methods

UNIT V Planning & Learning : Planning, Planning in Situational calculus ,Representation for planning ,Partial order palnning, Partial order palnning algorithm, Learning by Examples, Learning by Analogy, Explanation based learning, Neurals nets, Genetics algorithms

UNIT VI Minimax: Game playing strategy, Natural language processing ,Overview of linguistics , Grammer & Language, Transformation Grammer, Basic Parsing Techniques, Expert System, Architecture of Rule based Expert system ,Non Rule based Expert system.

References:

1. Artificial Intelligence by Elain Rich & Kevin Knight, Tata McGraw Hills Pub.

2. Principals of AI by Nills .J.Nilsson, Pearson Education Pub.
3. Artificial Intelligence by DAN. W.Petterson. Printice Hall of India
4. Artificial Intelligence by Petrick Henry Winston,
5. Artificial Intelligence by Russel and Norvig, Pearson Education Pub.

GC 102C CYBER LAWS AND SECURITY

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

UNIT I History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.

UNIT II Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges

UNIT III Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

UNIT IV Security metrics- Classification and their benefits Information Security & Law, IPR, Patent Law, Copyright Law, Legal Issues in Data mIning Security, Building Security into Software Life Cycle Ethics- Ethical Issues, Issues in Data and Software Privacy Cyber Crime Types & overview of Cyber Crimes

References:

1. Godbole, “ Information Systems Security”, Willey
2. Merkov, Breithaupt, “ Information Security”, Pearson Education
3. Yadav, “Foundations of Information Technology”, New Age, Delhi
4. Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill
5. Sood, “Cyber Laws Simplified”, Mc Graw Hill
6. Furnell, “Computer Insecurity”, Springer 7. IT Act 2000

GC- 103C SOFT COMPUTING

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

UNIT I Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms- Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms- perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perception Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

UNIT II Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

UNIT III Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

UNIT IV Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT V Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Genetic Algorithms, Scope & application areas, solution of 0-1 Knapsack problem using GA

References:

1. “Fuzzy sets and Fuzzy Logic: Theory and applications”, G.J. Klir, B. Yuan, PHI
2. “Introduction to Fuzzy sets and Fuzzy Logic”, M. Ganesh, PHI
3. “An Introduction to Fuzzy Control”, D. Driankov, H. Hellendoorn, M. Reinfrank, Narosa Publishing Company
4. “Neural Networks: A classroom approach”, Satish Kumar, Tata McGraw Hill
5. Haykin S., “Neural Networks-A Comprehensive Foundations”, Prentice-Hall International, New Jersey, 1999.

GC-104C WEB TECHNOLOGY AND INFORMATION RETRIEVAL

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

UNIT I Web Server Technology: Web's Robot global access to information, HTML, HTTP, Accessing a web server, publishing on web server, secure HTTP, Secure Sockets Layer, WWW Proxies, IIS, Case study of apache web server.

UNIT II Web Search Basics: Background and history, Anatomy of WWW, Web characteristics, Spam, The web graph, The Web Search Users, search engines, architecture of search engines, search tools, DNS resolution, The URL frontier, Link analysis, Page Rank.

UNIT III Web Crawlers: Basics of Web crawling, Various crawling techniques, incremental crawler, parallel crawler, distributed crawlers, focused crawler, agent based crawler, Hidden web Crawler

UNIT IV Introduction to Information Retrieval: Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

UNIT V Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression.

GC-105C INTELLECTUAL PROPERTY RIGHTS

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

UNIT I Introduction to Intellectual Property: Concept of Intellectual Property, Kinds of Intellectual Property, Economic Importance of Intellectual Property, **Indian Theory on Private Property:** Constitutional Aspects of Property, Constitutional Protection of Property and Intellectual Property, **Economic Development and Intellectual Property Rights Protection**

UNIT II Introduction to Patents: Overview, Historical Development, Concepts: Novelty, Utility, **Patentable Subject-matter:** Patent Act, 1970- Amendments of 1999, 2000, 2002 and 2005, Pharmaceutical Products and Process and Patent , Protection, Software Patents, Business Method, Protection of Plant Varieties and Farmers' Rights Act, 2001, Patenting of Micro-organism

UNIT III Procedure of Obtaining of Patents: Concepts of a Patent Application,, Specification: Provisional, Complete, Disclosure Aspects, Claims: Principal, Dependant, Omnibus, Examination of Application, Opposition of Application, Sealing of Patents

UNIT IV Working of Patents – Compulsory License: Commercialization of Inventions: License- Terms of License Agreement, Assignments of Patents, Revocation of Patents

UNIT V Infringement: What is Infringement?, How is Infringement determined? Who is an Infringer? Direct, Contributory and Induced, Defences of Infringement:

5.2.1 Research Exemption, Invalidity, Misuse, Failure to mark, Laches and Estoppel and first sale doctrine

References:

1. W.R. Cornish, Intellectual Property, Sweet & Maxwell, London (2000)
2. P. Narayana, Patent Law, Wadhwa Publication
3. Merges, Patent Law and Policy: Cases and Materials, 1996

4. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993
5. Brinkhof (Edited), Patent Cases, Wolters Kluwer.
6. Prof. Willem Hoyng & Frank Eijsvogels, Global Patent Litigation, Strategy and Practice, Wolters Kluwer.
7. Gregory Stobbs, Software Patents Worldwide, Wolters Kluwer.
8. Feroz Ali Khader, The Law of Patents- With a special focus on Pharmaceuticals in India, Lexis Nexis Butterworths Wadhwa, Nagpur.
9. Sookman, Computer Law, 1996
10. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009). Eastern Book Company, Lucknow.

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