SCHEME & SYLLABUS

for

B.TECH. COURSE

in

MECHANICAL ENGINEERING

(w.e.f. Session 2016-2017)

DEPARTMENT OF MECHANICAL ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD

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 calibre, 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 of Mechanical Engineering Department

YMCA University of Science & Technology, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, 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 field of engineering to meet specific technical manpower requirement of industries. Mechanical Engineering Department 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 govt. in 1st Year and 2nd year through lateral entry entrance test. Besides under graduate degree courses, it is also running M.Tech. Mech. Engg. Course (in specialization of 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. Department has pride on its number of students : Dinesh Kumar (2010 batch), Vinit Kumar (2010 batch), Ramandeep (2010 batch), Naveen Kumar (2011 batch) and Vipin Aggarwal (2012 batch), who had achieved all india rank 9,11,18,30 and 53 rd in GATE Entrance (2014 - 2016) respectively .

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. It has excellent faculty with 10 Professors, 04 Associate Professors and 16 Assistant Professors. At present, 21 faculty members are PhD in various specializations. 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.

With regards,

Dr M.L.Aggarwal

Chairman (ME)

Program Educational Objectives (PEO'S)

PEO-1:
A fundamental knowledge of the basic and engineering sciences and develop mathematical and analytical skills required for mechanical engineering.

PEO-2:
Graduates to be equipped with practical skills and experimental practices related to core and applied areas of mechanical engineering to expand their knowledge horizon beyond books. This will prepare the students to take-up career in industries or to pursue higher studies in mechanical and interdisciplinary programs.

PEO-3:
Graduates will have improved team building, team working and leadership skills with high regard for ethical values and social responsibilities.

PEO- 4:
Mechanical Graduates will explore and create innovations in various aspects of engineering.

PROGRAMME OUTCOMES (PO'S) B.TECH. MECHANICAL ENGINERING

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 contest 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 B.TECH. (MECHANICAL ENGINEERING)

SEMESTER I – VIII

(w.e.f. Session 2016-17)

Total Credits: 230 **Total Theory Subjects: 42**

Total Labs (including Drawing, Workshop, Seminar & Projects): 31

Total Industrial Training: 1

Total Teaching Schedule/Week:

Lectures	Practical	Total
166	112	278

Itemized Break-up:

	No.	Hours/Week	Total Marks	Credits
Theory Subjects: Discipline Core Course(DCC)=24 Discipline Elective Course(DEC)=4 Open Elective Course(OEC)=2 Basic Engg Course(BEC)=4 Basic Sc Course(BSC)= 5 Ability Enhancement Course(AEC)=3	42	162	4200	162
Labs	20	40	1000	20
Drawing Classes	2	8	200	4
Workshop	7	54	700	27
Presentation Skill: Seminar	1	2	50	1
Projects	1	8	100	4
Industrial Training	1	1 semester	500	12
Mandatory Audit Course(MAC)	2	4	-	-
Total			6750	230

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

PROPOSED SCHEME OF STUDIES & EXAMINATIONS

B.TECH 1ST YEAR (SEMESTER – I) CE/ IT/ MECH ENGINEERING (2016-2017)

	Course No	Course Title	Teaching Sched- -l -			Marks For Sessionals	Marks for End Term Examination		TOTAL MARKS	CREDITS
			L	P	TOTAL		THEORY	PRACTICAL		
BSC	HAS-101	Physics-I	4	0	4	40	60	-	100	4
	HAS-103	Mathematics-I	4	0	4	40	60	-	100	4
	HAS-105	Chemistry	4	0	4	40	60	-	100	4
	HAS-109	Physics Lab-I	0	2	2	30	-	20	50	1
	HAS 114	Chemistry Lab	0	2	2	30	-	20	50	1
AEC	MGMT-101	Fundamentals of Management	4	0	4	40	60	-	100	4
	HAS-107	Environmental Studies	4	0	4	40	60	-	100	4
BEC	E-101	Elements of Electronics Engineering	4	0	4	40	60	-	100	4
	MU-101A	Basics of Mechanical Engineering	4	0	4	40	60	-	100	4
	MU-102A	Basics of Mechanical Engineering Lab	0	2	2	30	-	20	50	1
	MU-104	Workshop-I	0	8	8	60	-	40	100	4
		Total	28	14	42	430	420	100	950	35

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
PROPOSED SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1ST YEAR (SEMESTER –II) CE/IT/ MECH ENGINEERING (2016-2017)

	Course No	Course Title	Teaching Schedule			Marks For Sessionals	Marks for End Term Examination		TOTAL MARKS	CREDITS
			L	P	TOTAL		THEORY	PRACTICAL		
BSC	HAS-102	Physics-II	4	0	4	40	60	-	100	4
	HAS-104	Mathematics-II	4	0	4	40	60	-	100	4
	HAS-110	Physics Lab-II	0	2	2	30	-	20	50	1
AEC	HAS-111	Essentials of Communication	4	0	4	40	60	-	100	4
	HAS 112	Language lab	0	2	2	30	-	20	50	1
BEC	E-105	Electrical Technology	4	0	4	40	60	-	100	4
	CE-101	Fundamentals of Computer & Programming with C	4	0	4	40	60	-	100	4
	MU-103A	Engineering Drawing	0	4	4	60	40	-	100	2
	CE-103	Fundamentals of Computer & Programming with C Lab	0	2	2	30	-	20	50	1
	E-109	Electrical Technology Lab	0	2	2	30	-	20	50	1
	MU-105	Workshop- II	0	8	8	60	-	40	100	4
		Total	20	20	40	440	340	120	900	30

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 2nd YEAR (SEMESTER – III) MECHANICAL ENGINEERING (2016-17)

Course No	Course Title	Teaching Schedule			Marks For Sessional	Marks for End Term Examination		TOTAL MARKS	CREDITS	Category Code
		L	P	TOTAL		THEORY	PRACTICAL			
MU-201A	Strength of Materials - I	4	-	4	40	60	-	100	4	DCC
MU-203A	Fluid Mechanics	4	-	4	40	60	-	100	4	DCC
MU-205A	Engineering Mechanics	4	-	4	40	60	-	100	4	DCC
MU-207A	Thermodynamics	4	-	4	40	60	-	100	4	DCC
MU-209A	Manufacturing Science - I	4	-	4	40	60	-	100	4	DCC
MU-211A	Strength of Materials Lab	-	2	2	30	-	20	50	1	DCC
MU-213A	Fluid Mechanics Lab	-	2	2	30	-	20	50	1	DCC
MU-215A	Computer Aided Drafting Lab	-	2	2	30	-	20	50	1	DCC
MU-217A	Machine Drawing	-	4	4	40	60	-	100	2	DCC
MU-219A	Workshop - III	-	8	8	60	-	40	100	4	SEC
MU-221A (AUD)	Mandatory Audit Course-1	2	-	2					-	AUD
	TOTAL	22	18	40	390	360	100	850	29	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 08 hours duration

(c) Workshop exam will be of 8 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 2nd YEAR (SEMESTER – IV) MECHANICAL ENGINEERING (2016-17)

Course No.	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Categoty Code
		L	P	Total		Theory	Practical			
MU-202A	Kinematics of Machines	4	-	4	40	60	-	100	4	DCC
MU-204A	Strength of Materials – II	4	-	4	40	60	-	100	4	DCC
MU-206A	Applied Thermodynamics	4	-	4	40	60	-	100	4	DCC
MU-208A	Fluid Machines	4	-	4	40	60	-	100	4	DCC
MU-210A	Material Science and Engineering	4	-	4	40	60	-	100	4	DCC
MU-212A	Manufacturing Science – II	4	-	4	40	60	-	100	4	DCC
MU-214A	Kinematics of Machines Lab	-	2	2	30	-	20	50	1	DCC
MU-216A	Applied Thermodynamics Lab	-	2	2	30	-	20	50	1	DCC
MU-218A	Fluid Machines Lab	-	2	2	30	-	20	50	1	DCC
MU-220A	Material Science Lab	-	2	2	30	-	20	50	1	DCC
MU- 222A	Workshop - IV	-	6	6	60	-	40	100	3	SEC
MU224A(AUD)	Mandatory Audit Course-II	2	-	2					-	AUD
	TOTAL	26	14	40	420	360	120	900	31	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 8 hours duration

(c) Workshop exam will be of 8 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 3rd YEAR (SEMESTER – V) MECHANICAL ENGINEERING (2016-17)

Course No.	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Cat. Code
		L	P	Total		Theory	Practical			
MU-301A	Dynamics of Machines	4	-	4	40	60	-	100	4	DCC
MU-303A	Refrigeration and Air-Conditioning	4	-	4	40	60	-	100	4	DCC
MU-305A	Internal Combustion Engines	4	-	4	40	60	-	100	4	DCC
MU-307A	Machine Design – I	4	-	4	40	60	-	100	4	DCC
MU-309A	Numerical Analysis and Computer Programming	4	-	4	40	60	-	100	4	DCC
MU-311A	Discipline Elective Course-1*	3	--	3	40	60	-	100	3	DEC
MU-313A	Open Elective Course-1*	3	-	3	40	60	-	100	3	OEC
MU-315A	Dynamics of Machines Lab	-	2	2	30	-	20	50	1	DCC
MU-317A	Refrigeration and Air-Conditioning Lab	-	2	2	30	-	20	50	1	DCC
MU-319A	Internal Combustion Engines Lab	-	2	2	30	-	20	50	1	DCC
MU-321A	Workshop-V	-	8	8	60	-	40	100	4	SEC
	Total	26	14	40	430	420	100	950	33	

Note: Exams duration will be as under

(a) Theory exams will be of 3 hours duration.
(b) Practical exams will be of 8 hours duration
(c) Workshop exam will be of 8 hours duration

MU311A: Discipline Elective Course-1*

1. Product Design and Development - MU311A (1)
2. Air-Conditioning Equipments - MU311A (2)
3 Welding Technology- MU311A (3)
4. Machine Tool Technology- MU311A (4)
5. Power Plant Engineering- MU311A (5)
6. Metallurgy- MU311A (6)

The student will have to select one subject each from list of Electives course.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 3rd YEAR (SEMESTER – VI) MECHANICAL ENGINEERING (2016-17)

Course No.	Course Title	Teaching schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Cat. Code
		L	P	Total		Theory	Practical			
MU-302A	Computer Aided Design	4	-	4	40	60	-	100	4	DCC
MU-304A	Numerical Control of Machine Tools and Robotics	4	-	4	40	60	-	100	4	DCC
MU-306A	Heat and Mass Transfer	4	-	4	40	60	-	100	4	DCC
MU-308A	Machine Design - II	4	-	4	40	60	-	100	4	DCC
MU-310A	Industrial Engineering	4	-	4	40	60	-	100	4	DCC
MU-312A	Discipline Elective Course- II*	3	-	3	40	60	-	100	3	DEC
MU-314A	Computer Aided Design Lab	-	2	2	30	-	20	50	1	DCC
MU-316A	Numeric Control of Machine Tools and Robotics lab	-	2	2	30	-	20	50	1	DCC
MU-318A	Heat and Mass Transfer Lab	-	2	2	30	-	20	50	1	DCC
MU-320A	Presentation Skill Development	-	2	2	50	-	-	50	1	AEC
MU322A	Workshop - VI	-	8	8	60	-	40	100	4	SEC
	Total	23	16	39	440	360	100	900	31	

MU312A :Discipline Elective Course-II*

1. Tooling for Production - MU312A (1)
2. Welding and Sheet metal Design and Drawing- MU312A (2)
3. Estimation and Design of RAC plants- MU312A (3)
4. Mechatronics- MU312A (4)
5. Flexible Manufacturing Systems- MU312A (5)
6. Design of Thermal Systems- MU312A (6)

*The student will have to select one subject each from list of Electives and open elective course.

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.
(b) Practical exams will be of 8 hours duration
(c) Workshop exam will be of 8 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 4th YEAR (SEMESTER – VII) MECHANICAL ENGINEERING (2016-17)

Credits: 12

S.No.	Course No.	Subject	Teaching Schedule	**Examination Schedule** (Marks)		
				Annual Exam	Continuous Assessment	Total
1.	MU-401A	Industrial Training	8 hours per day for one semester	200	300	500

Procedure for Annual Exam and Continuous Assessment of Industrial Training:

(A) Annual Exams Marks

1. Training Evaluation 50 Marks
2. Training Seminar 50 Marks
3. Training Viva 100 Marks

(B) Continuous Assessment Marks

1. Assessment by Institute faculty 100 Marks
2. Assessment by Industrial Guide 150 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 (2016-17)

Course No.	Course Title	Teaching schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Cat. Code
		L	P	Total		Theory	Practical			
MU-402A	Automobile Engineering	4	-	4	40	60	-	100	4	DCC
MU-404A	Vibrations and Noise Control	4	-	4	40	60	-	100	4	DCC
MU-406A	Operations Research	4	-	4	40	60	-	100	4	DCC
MU-408A	Discipline Elective Course-III*	3	-	3	40	60	-	100	3	DEC
MU-410A	Discipline Elective Course- IV*	3	-	3	40	60	-	100	3	DEC
MU-412A	Open Elective Course-II*	3	-	3	40	60	-	100	3	OEC
MU-414A	Project	-	8	8	60	-	40	100	4	SEC
MU-416A	Workshop- VII	-	8	8	60	-	40	100	4	SEC
	Total	21	16	37	360	360	80	800	29	

MU408A:Discipline Elective Course-III*

1. Ergonomics and Workplace design - MU408A (1)
2. Project Management- MU408A (2)
3. Non-conventional Energy Resource Utilization- MU408A (3)
4. Management Information System- MU408A (4)
5. Concurrent Engineering- MU408A (5)
6. Management Science- MU408A (6)
7. Marketing Management- MU408A (7)

MU410A:Discipline Elective Course-IV*

1. Economics and Information Security - MU410A (1)
2. Metrology and Measurement- MU410A (2)
3. Plastics Mould Manufacturing - MU410A (3)
4. Robotic Engineering- MU410A (4)
5. Industrial Controls- MU410A (5)
6. Solid Waste - MU410A (6)

*The student will have to select one subject each from list of Discipline Electives and open elective course.

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.
(b) Practical exams will be of 08 hours duration
(c) Workshop exam will be of 8 hours duration

Open Elective Course-I &II
MU313A and MU412A(Two different Open Elective Course-I &II)

Courses offered by Computer Engg. Dept

S.No	Code	Name of Subject
1	OEC-1	Intelligent Systems
2	OEC-2	Cyber laws and Security
3	OEC-3	Soft Computing
4	OEC-4	Web Technology and Information Retrieval
5	OEC-5	Intellectual Property and Rights

Courses offered by Electrical Engg. Dept

S.No	Code	Name of Subject
1	OEC-6	Installation Testing & Maintenance of Electrical Equipments
2	OEC-7	Non conventional energy resources & Utilization
3	OEC-8	Utilization of Electrical Power & Traction

Courses offered by Mechanical Engg. Department(**Not allowed for ME Deptt. Students**):

S.No	Code	Name of Subject
1	OEC-9	Industrial Engineering
2	OEC-10	Total Quality Management
3	OEC-11	Solid Waste
4	OEC-12	Product Design and Development
5	OEC-13	Robotics Engineering
6	OEC-14	Power Plant Engineering

- Courses offered by Electronics Engg. Deptt.

S.No	Code	Name of Subject
1	OEC-15	Microprocessor and Interfacing
2	OEC-16	Digital Signal Processing
3	OEC-17	Instrumentation and Control
4	OEC-18	Data Communication and Networking

- Courses offered by HAS Dept

S.No	Code	Name of Subject
1	OEC-19	Soft Skills for Engineers
2	OEC-20	Maths-III

- Courses offered by MBA Dept

S.No	Code	Name of Subject
1	OEC-21	Human Resource Management
2	OEC-22	Financial Management
3	OEC-23	Marketing Management
4	OEC-24	Entrepreneur Development
5	OEC-25	Principles of Management & Economics

MU221-A & MU 224A: Mandatory Audit Course
(Two different Course-I &II)

Subject	**Code**
• German -1	AUD-01
• German-2 (with German-1 as prerequisite)	AUD-02
• French -1	AUD-03
• French-2 (with French-1 as prerequisite)	AUD-04
• Sanskrit -1	AUD-05
• Sanskrit-2 (with Sanskrit-1 as prerequisite)	AUD-06
• Personality Development	AUD-07
• Interview and Group Discussion Skills	AUD-08
• Yoga and Meditation	AUD-09
• Art of Living/ Life Skills	AUD-10
• Contribution of NSS towards Nation/Role of NSS	AUD-11
• Physical Education	AUD-12

NOTE FOR THEORY PAPERS:
Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

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

B. TECH. I SEMESTER

HAS 101: PHYSICS I

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

An introduction to general optical physics with topics to include interference, diffraction, polarization, fiber optics, lasers. The second part consists of theory of relativity, electrostatics and superconductivity.

SYLLABUS

Part –A

INTERFERENCE

Coherent sources, conditions for sustained interference. Division of Wave-Front - Fresnel's Biprism, Division of Amplitude- Wedge-shaped film, Newton's Rings, Michelson Interferometer, applications (Resolution of closely spaced spectral lines, determination of wavelengths), Elastic property of glass by Newton rings method

DIFFRACTION

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

Part- B

POLARISATION

Polarised and unpolarised light, Uniaxial crystals 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 action, 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, attenuation, dispersion, applications

Part -C

ELECTROSTATICS AND ELECTRODYNAMICS

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.

Part-D

SPECIAL THEORY OF RELATIVITY

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.

SUPERCONDUCTIVITY

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

COURSE OUTCOMES

- Knowledge of the Fundamentals of optical Physics
- Explain wave propagation of light, interference, diffraction, and polarization of light waves, and the electromagnetic nature of light.
- Proficiency in solving problems in Special theory of Relativity.
- Developing interest in the field of superconductivity.
- Understand the Utilization of laser technology in various disciplines and also understand the concept of optical fiber and its applications.

TEXT BOOKS

- Perspectives of Modern Physics - Arthur Beiser (TMH)
- Optics - AjoyGhatak (TMH)
- Modern Physics for Engineers – S.P.Taneja (R. Chand)
- Engineering Physics – SatyaPrakash (PragatiPrakashan)
- Modern Engineering Physics – A.S.Vasudeva (S. Chand)
- Engineering Physics (vol-1)- S.L. Gupta

REFERENCES

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

B. TECH. II SEMESTER

CODE: HAS 102

SUBJECT NAME: PHYSICS II

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

CRYSTAL STRUCTURE

Space lattice, unit cell and translation vector, Miller indices, simple crystal structure, Laue's treatment to Bragg's law, powder method, Point defects in solids – Schottky and Frenkel defects. Bonding in solids- Ionic and covalent bonds, Introduction to liquid crystals and applications.

QUANTUM PHYSICS

COURSE OBJECTIVE:

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 able to know the overview about Nanotechnology

SYLLABUS

PART A

Difficulties with Classical physics, Introduction to quantum mechanics-simple concepts. Black Body radiations Discovery of Planck's constant, phase velocity and group velocity. Schrodinger wave equations-time dependent and time independent, Expectation value, Ehrnfest Theorem, particle in a one-dimensional box. Quantum Statistics (Bose-Einstein and Fermi-Dirac Statistics).

PART B

NANOMATERIALS AND APPLICATIONS

Nanomaterials: Introduction , synthesis of nanoparticles,, properties of nanoparticles-Mechanical, optical, magnetic and electronic; Carbon nanotubes-types of nanotubes , synthesis and uses of nanotubes; Applications of nanotechnology.

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.

PART C
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, photovoltaics cells, solar cell and its characteristics, storage of solar energy

PART D
ELEMENTARY REACTOR TECHNIQUES
Radiation detectors: cloud chamber, bubble chamber, Operation and working of nuclear reactor, Reactor safety measures, nuclear cross-section, fission, fusion, impact parameter, reactor fuels

Program Outcomes:
At the completion of this course, students will be able to:

- describe the behavior of and make predictions regarding the phenomena of the physical world.
- apply fundamental principles of physics to solve problems related to quantum mechanics, solid state, magnetism and photoconductivity.
- be able to know about the fundamental concepts of nano technology and its applications in various field.

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 – SatyaPrakash (Pragati Prakashan)
5. Modern Engineering Physics – A.S.Vasudeva (S. Chand)
6. Engineering Physics (vol-1)- S.L. Gupta

Reference Books:
1. Fundamentals of Physics – Resnick & Halliday (Asian Book)
2. Introduction to Electrodynamics – D.J. Griffith (Prentice Hall)
3. Nuclear Physics- D.C. Tayal(Himalaya Publishing House)

B. TECH. I SEMESTER

CODE: HAS 103

SUBJECT NAME: MATHEMATICS I

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVES

To gain knowledge about: Laplace Transform, Vector Calculus, Double Integral, Triple Integral, Infinite series and partial differential equation.

SYLLABUS

PART-A

MATRICES AND ITS APPLICATIONS

Rank of Matrix, Normal form, Inverse using Gauss-Jordon method, Consistancy 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.

PART-B

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 Ist 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).

PART-C

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.

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 with their simple applications.

COURSE OUTCOMES:

- Apply the knowledge of Mathematics in Physical sciences and Engineering.
- Identify, formulate and solve Engineering problems.
- Modeling of Physical Problems to Mathematical problems.
- Acquire knowledge of Matrix Algebra, Determinants and their applications in engineering subjects.
- Acquire knowledge about Advance Calculus.
- Acquire knowledge about Series solution of Differential equations.
- Acquire knowledge about orthogonal polynomials and their Properties.
- Acquire knowledge about Gamma and Beta function, error function.

TEXT BOOKS

- B.S.Grewal, Higher Engg. Mathematics, Khanna Publications.
- Reena Garg,R S Goel, Deepankar Sharma,Engg. Mathematics-I, Khanna Publications

REFERENCES

- Advanced Engineering Mathematics, Erwin Kreyzig
- Advanced Engineering Mathematics, Dr. Babu Ram, Pearsons publications

B. TECH. II SEMESTER

CODE: HAS 104

SUBJECT NAME: MATHEMATICS II

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVES:
To gain knowledge about: Ordinary Differential Equations, Laplace Transform, Partial Differential Equations, and Vector Calculus

SYLLABUS

PART-A

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 = 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, Newton's law of cooling, Heat flow , Orthogonal trajectory.

Part B

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, Laplace-transforms of Unit-step function, unit-impluse function and periodic function, 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.

PARTIAL DIFFERENTIAL EQUATION

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.

Part C

INFINITE SERIES

Convergence and divergence of infinite series, Comparison Test , D'Alembert's Ratio Test, Gauss Test, Raabe's test, Logarithmic Test, Cauchy's Root Test, Alternating series, Conditional convergence & absolute convergence.

Text Books:

- B.S.Grewal - Engg. Mathematics
- H.C.Taneja - Engg. Mathematics
- R.S. Goyal - Engg. Mathematics
- Babu Ram -Engg. Mathematics

Course Outcome:

- Acquire knowledge about Differential Equations(Ordinary and Partial)
- Acquire knowledge about solving Differential Equations.
- Acquire knowledge Vector Calculus.
- Acquire knowledge about Laplace Transform.

B. TECH. I/II SEMESTER

CODE: HAS 105

SUBJECT NAME: CHEMISTRY

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

	Sessional: 40 Marks
L T P	Theory : 60 Marks
4 0 0	Total : 100 Marks

To apply the fundamental knowledge of Chemistry in engineering and technology and to analyze it with experiments.

UNIT-1- 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.

UNIT-2-PHASE RULE:
Terminology, Derivation of Gibb's phase rule. One component system (H_2O system, Sulphur system), two components systems: Simple eutectic system (Pb – Ag), system with congruent melting point (Zn – Mg), Cooling curves.

UNIT-3-WATER AND ITS TREATMENT Part – I:

Sources of water, impurities in water, 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.

UNIT-4-WATER AND ITS TREATMENT Part – II:

Treatment of water for domestic use: coagulation, sedimentation, filteration and disinfection. Water softening : Lime-Soda treatment, Zeolite, Ion – exchange process, Mixed bed demineralization, Eutrophication, Desalination (Reverse Osmosis, Electrodialysis).

UNIT-5-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.

UNIT-6-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-7-: 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

UNIT-8-INSTRUMENTAL METHODS OF ANALYSIS :

Principle and application of Thermal methods of Analysis. (TGA, DTA, DSC), Basic concepts of spectroscopy, Absorption and Emission spectroscopy Different spectroscopic Techniques (UV-Visible and IR spectroscopy) elementary discussion on Flame photometry.

Course Outcomes:
After successful completion of this course, the student would be able to :

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

Books recommended

1. Engineering Chemistry , P.C. Jain, Monica Jain (Dhanpat Rai & Co)
2. Chemistry in Engineering & Tech , Vol. I & II , Kuriacose (TMH)
3. Instrumental methods of Chemical analysis, MERITT & WILLARD(EAST - WEST press)
4. Physical Chemistry , P.W Atkin (ELBS, OXFORD Press)
5. Physical Chemistry W.J.Moore (Orient Longman)

B. TECH. I & II SEMESTER

CODE: HAS 107

SUBJECT NAME: ENVIRONMENTAL STUDIES

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

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.

SYLLABUS

UNIT 1: THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance. Need for public awareness.

UNIT 2: 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 3: 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 4: 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 5: ENVIRONMENTAL POLLUTION

Definition

- Causes, effects and control measures of :

  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 6: 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 7: 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 8: 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.

COURSE OUTCOMES

Upon completion of this course, a fully-engaged student will be able to:

- Understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development.
- Introduce the thinking about environmental issues from an interdisciplinary perspective.
- Identify and relate about the renewable and non-renewable resources, their importance and ways of conservation to sustain human life on earth.
- 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.
- Recognize, relate and become sensitive to the effects of pollution and will be able to contribute his learning's towards their prevention or mitigation.

- Describe the social issues along with the trends of human population growth and the possible means to combat the challenges.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

B. TECH. II SEMESTER

HAS- 109

PHYSICS LAB – I

NO. OF CREDITS: 1

			SESSIONAL	: 30
L	T	P	THEORY EXAM	: 20
0	0	2	TOTAL	: 50

Course Objective:

A physics lab reinforces the theory class with required physics lab experiments to stress the fundamental concepts of physics. Optical experiments, which will establish the fundamental interference, diffraction phenomena which will be clearly visualized with the experiment mentioned the syllabus.

LISTS OF EXPERIMENTS:

1. To find the wavelength of sodium light by Newton's rings experiment.
2. To find the wavelength of sodium light by Fresnel's biprism experiment.
3. To find the wavelength of various colours of white light with the help of a plane transmission diffraction grating.
4. To find the refractive index and Cauchy's constants of a prism by using spectrometer.
5. To find the wavelength of sodium light by Michelson interferometer.
6. To find the resolving power of a telescope.
7. To find the pitch of a screw using He-Ne laser
8. To find the specific rotation of sugar solution by using a polarimeter.
9. To compare the capacitances of two capacitors by De'sauty bridge and hence to find the dielectric constant of a medium.
10. To find the flashing and quenching potentials of Argon and also to find the capacitance of unknown capacitor.
11. To study the photo-conducting cell and hence to verify the inverse square law.
12. To find the temperature co-efficient of resistance by using platinum resistance thermometer and Callender and Griffith bridge.
13. To find the frequency of A.C. mains by using Sonometer.
14. To find the velocity of ultrasonic waves in non-conducting medium by piezo-electric method.

Note :

(i) The experiments in Ist semester will be based mainly upon Optics, Electrostatics,
(ii) Students will be required to perform at least 10 experiments out of the list.

Course Outcomes:

- The students can able to determine the wavelength of different colour using different instruments.
- The students can able to find the frequency using different apparatus and handle other fundamental apparatus.

Recommended Book:

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

B. TECH. II SEMESTER

HAS- 110

PHYSICS LAB – II

NO. OF CREDITS: 1

			SESSIONAL	: 30
L	T	P	THEORY EXAM	: 20
0	0	2	TOTAL	: 50

COURSE OBJECTIVE:

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.

CONTENT:

- To find the low resistance by carey - Foster's bridge.
- To find the resistance of a galvanometer by Thomson's constant deflection method using a post office box.

- To find the value of high resistances by Substitution method.
- To find the value of high resistances by Leakage method.
- To study the characteristics of a solar cell and to find the fill factor.

- To find the value of e/m for electrons by Helical method.
- To find the ionization potential of Argon/Mercury using a thyratron tube.
- To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
- To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
- To find the value of Planck's constant by using a photo electric cell.
- To find the value of co-efficient of self-inductance by using a Rayleigh bridge.
- To find the value of Hall Co-efficient of semi-conductor.
- To study the V-I characteristics of a p-n diode.
- To find the band gap of intrinsic semi-conductor using four probe method.
- To calculate the hysteresis loss by tracing a B-H curve.

PROGRAMME OUTCOME:

On successful completion of this course, students should be able to

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

RECOMMENDED BOOKS :

- Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
- Practical Physics – S.L.Gupta& V.Kumar (Pragati Prakashan).
- Advanced Practical Physics Vol. I& II – Chauhan & Singh (Pragati Prakashan).

B. TECH. I /II SEMESTER

CODE: HAS 111

SUBJECT NAME: English for Engineers (IEE)

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

Objective:
It aims to inculcate interest towards literary pursuits and creative writing in students. Their imaginative faculties will be harnessed for the purpose of originality and ability to think independently. Furthermore, the aim is to enhance their critical thinking and develop aptitude for formal writing and oral discussions. They are guided and given exercises to improve their vocabulary during the course, simultaneously through classroom and lab exercises the students gain confidence in their own ability to express their thoughts and articulate ideas.

Unit –I- COMPREHENSION & COMPOSITION
Excerpt from John Updike's *Cosmic Gall*; Paragraphs/Essays; Unseen Passage & Comprehension exercises derived from features, articles and editorials; exercises in creative writing and impromptu/extempore speech; Anecdotes/stories; Deconstructing & Re-framing Quotes; Verse composition; Dialogue-writing; Story-building and storyboards; travelogue.

Unit-II-TECHNICAL WRITING
Format of Long Reports, Interoffice Memorandum, Format and layout of a typical business letter; Covering letter and Resume; Analytical and Descriptive writing.

Unit –III- SEMANTICS & SYNTAX
One-word substitutes, Idioms & Proverbs, Vocabulary building; Crosswords, Sentence Correction/Editing.

Unit-IV: CORPORATE INTERACTION & COMMUNICATION
Presentations; drafting and creating effective presentations; drafting speeches ; taking interviews; preparing for interviews; brainstorming for Group Discussions, declamations and debates; , Corporate Dialogue: Conflict-Resolution exercises; Role Play.

COURSE OUTCOMES:

- Students are equipped with a better vocabulary, confidence to express themselves and must show remarkable interest in conveying their ideas by the end of the course.
- Students will learn creative writing.

- Students will learn basic formal writing.
- 'Student-centric' exercises with the emphasis on interpersonnel communication skills will give the students greater confidence in their ability to communicate and persuade.

References:

- National dailies like *Hindu, HT, TOI, Tribune* (e-versions available)
- Magazines like *NatGeo, Outlook, India Today*
- Raman, Meenakshi and Sangeeta Sharma. *Technical Communication*. Oxford: 2011
- Wehmeier, Sally .*Oxford Advanced Learner's Dictionary*. Oxford UP.8th edition.
- Ghosh, BN. *Managing Soft Skills for Personality Development*. Tata McGraw-Hill 2012
- Rizvi, M Ashraf. *Effective Technical Communication*. Tata Mc Graw-Hill.2005
- Bretag, Crossman and Bordia. Communication Skills. Tata Mc Graw-Hill.2009
- Blogs: Eng_lessons_dj.blogspot.com
- Renaissanceymcaust.blogspot.com

B. TECH. I / II SEMESTER
HAS- 112
LANGUAGE LAB
NO. OF CREDITS: 1

			SESSIONAL	: 30
L	T	P	THEORY EXAM	: 20
0	0	2	TOTAL	: 50

Objective: 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.

CORPORATE INTERACTION & COMMUNICATION

I. Presentations
II. 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
III. Group Discussions, Corporate Dialogue: Conflict-Resolution exercises; Role Play; Mock-interviews.
IV. 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.

Outcome:

- The students will be trained to respond better to new scenarios that demand good communication skills.
- The students will be able to resolve potential conflicts by avoiding communication gaps and overcoming barriers.
- Students will learn to use skills effectively for enhancing performance and even improving upon their power to persuade.

References:

- Language Lab Software(subject to availability)
- PPTs

B. TECH. I / II SEMESTER
HAS- 114
CHEMISTRY LAB
NO. OF CREDITS: 1

			SESSIONAL	: 30
L	T	P	THEORY EXAM	: 20
0	0	2	TOTAL	: 50

Course Objectives:

To apply fundamental knowledge of practical chemistry to engineering and technology

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 & N0. 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 spectrophotomererically
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

Course Outcomes:

- After successful completion of this course, the student would be able to :
- Find out hardness of water quantitatively.
- Analysr sample of water for many parameters
- Analysr sample of lubricating oil for many parameters
- Prepare polymeric resins in the laboratory

Books recommended

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

B. TECH. I/II SEM

CODE: MGMT-101

SUBJECT NAME: FUNDAMENTALS OF MANAGEMENT

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

Course Objectives:

The course takes a general management perspective, with emphasis on skills and concepts essential to successful management careers. The course seeks to explain basic concepts, principles and processes in HR/Marketing/Finance/Operations, with an idea to acquaint the students with these disciplines, to suit the industry needs. To improve the their communication skills; help them examine the complexity of business scenario in the changing global context; and give exposure to several models of leadership. Prepare assignments on case-study to understand the dynamics of the corporate world- the past history or present practices of a company.

SYLLABUS

Unit I

Concept and significance of Management, Functions of management and their interrelationship, levels of Management and skills required at various levels, Management vs. Administration, Management as art, science or profession.

Unit II

Human Resource Management- Functions of HRM; Source of recruitment and selection process, Training needs and types, Motivation Theories – Maslow's need Hierarchy theory, Mc Gregor's Theory X and Y, Herzberg Theory.

Unit III

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

Unit IV

Production Management- Functions and scope of production management, Production Planning and Control- Stages of PPC, Meaning and methods of inventory control, Concept of TQM (In brief)

Unit V

Financial Management- Functions of Financial Management, Sources of finance, Factors effecting Capital Structure of a company.

Unit VI

Case Study (For Assignment Only)

Course Outcomes:

- The students will develop a knowledge framework with diverse perspectives and disciplines within management.
- They will have capacity to go beyond theoretical knowledge, demonstrate an ability to apply general management knowhow in practical business situations.
- They will be expected to develop an understanding of concepts in a rapidly changing global business context.
- Develop skills in time management and planning work assignments. The soft skills will be help gain confidence and develop personality.

Books

- Gupta R. S., Sharma B.D., Bhalla N. S., Principle and Practices of Management, Kalyani Publishers
- Chhabra T. N., Principles and Practices of Management, Dhanpat Rai & Co.
- Prasad L. M., Principles and Practices of Management, Sultan Chand & Sons
- Gupta C. B., Management (Theory and Practice), Sultan Chand & Sons

B. TECH. I/II SEM

CODE: MU-101A

BASICS OF MECHANICAL ENGINEERING

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	0	0	TOTAL	: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

Course Objective

To study various concepts of thermodynamics, refrigeration and IC engines. To study principles and application of manufacturing processes. To study the power transmission devices such as belt, gears, clutches and brakes.

Unit I

Basic Concepts of Thermodynamics and Refrigeration: Introduction, Systems, Work, Heat, Temperature, Zeroth, 1st, 2nd laws of Thermodynamics, Concept of internal energy, Problems. Introduction to Refrigeration & Air conditioning, units of refrigeration, Coefficient of performance, Difference between a Heat engine refrigerator and heat pump, simple refrigeration vapour compression cycle, simple problems on Coefficient of performance

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

Power Transmission Methods and Devices: Introduction to Power transmission, Belt drive, Rope drive, Chain drive, Gear drive, Types of gears, Clutches, Types and function of clutches, Types and function of brakes.

Unit IV

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, single and double purchase winch crabs, Simple and differential screw jacks, Problems.

Unit V

Stresses and Strains: Introduction, Concept & types of Stresses and Strains, Poisons 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

Manufacturing Processes: Brief introduction to classification of different manufacturing processes: Primary shaping processes, metal cutting processes, joining processes, finishing processes and processes bringing change in properties , Welding: Introduction to EAW, Gas welding, Soldering and Brazing.

Unit VII

Manufacturing Systems and Machine Tools: Introduction to Manufacturing Systems, Principal and parts of commonly used machine tools in Workshop such as Lathe, Shaper and Milling. Fundamentals of Numerical Control (NC), Advantage of NC systems, Classification of NC and CNC.

Course Outcomes:

- At the end of the course, the student shall be able to:
- Understand the basic principles of internal combustion engines.
- Understand the principles and applications of various manufacturing processes.
- Understand the concept of strain and strain for the strength of materials.
- Grasp the concepts of power transmission devices.
- Understand methods of thermodynamics, refrigeration & air conditioning in mechanical system.

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. Refrigeration & Air conditioning- Arora & Domkundwar, Dhanpat Rai & Co. Pvt. Ltd.
5. Workshop Technology Vol I &II –Hazra & Chaudhary, Asian Book Comp., New Delhi.

Reference Books

1. Strength of Materials– Popov, Pub. - PHI, New Delhi.
2. Strength of Materials– G.H Ryder, Pub-ELBS.
3. Engineering Thermodynamics- C.P Arora, Pub- TMH, New Delhi.
4. Refrigeration & Air conditioning- C.P Arora, Pub- TMH, New Delhi.
5. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, - East- West Press.
6. Manufacturing Process & Systems- Oswald, Munoz, John Wiley.
7. Workshop Technology Vol I, II & III- Chapman, WAJ, Edward Arnold.
8. Basics of Mechanical Engineering – Vineet Jain, Dhanpat Rai Publications

B. TECH. I/II SEM

CODE: MU-103A

ENGINEERING DRAWING

NO. OF CREDITS: 2

			Sessional	: 60
L	T	P	Practical	: 40
0	0	4	TOTAL	: 100

Course Objective

To study various concepts of orthographic and isometric projection. To study projection of points, planes, lines, solids and development of surfaced. To study lettering, dimensioning , first angle and third angle projection methods.

Unit 1

Introduction: Importance and scope of Engineering Drawing, Instruments, Lettering, Types of lines, Dimensioning, Scales, Different methods of projections, B.I.S Specifications.

Unit 2

Projection of Points : Introduction to plane of projection, reference & auxiliary planes, projection of points in different quadrants, traces, true inclinations & true lengths of the lines, projections on auxiliary plane.

Unit 3

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 4

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

Unit 5

Projection 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.

Unit 6

Projection of Section of Solids: Projection of section of prisms, pyramids, cylinders and cones with axis perpendicular to one reference plane and parallel to the other reference plane.

Unit 7

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

Unit 8

Isometric Projection: Introduction, Isometric scale, Isometric projections/ view of plane figures like prisms, pyramids, cylinders and cones.

Unit 9

Orthographic Projections: Orthographic projections of machines components and Nuts, Bolted Joints, Screw threads, Screw joints

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

- Understand the basic principles of projections.
- Understand and draw orthographic and isometric view of an object.
- Grasp the concepts of development of surfaces.
- Understand methods of drawing nuts, bolts and screw threads.
- Understand projection of points, lines, planes and solids.

Reference 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 with Auto CAD 2002 - James D.Bethune, Pearson Education.
4. A Text Book of Machine Drawing Laxmi Narayana and Mathur, M/s. Jain Brothers, New Delhi.
5. Machine drawing by N Sidheshwar, Kannaieh, V S Sastry, TMH., New Delhi.
6. Fundamentals of Engineering Drawing by Luzaddder: PHI.
7. Fundamentals of Engineering Drawing by French and Vierk; Mc Graw H

B. TECH. I/II SEM

CODE: MU-102A

BASICS OF MECHANICAL ENGG. LAB

NO. OF CREDITS: 1

L	T	P	Total
0	0	2	2

Sessional:	30 Marks
Practical:	20 Marks
Total :	50 Marks
Duration of Exam:	2 Hours

Course Objective

To study various concepts of boilers, mountings and accessories. To study four stoke and two stroke engines. To calculate performance of study single purchase, double purchase winch crabs,screw jack and worm wheel. To study COP of refrigeration system and knowledge of air-conditioner

List of Experiments:

1. To study the Cochran and Babcock and Wilcox boilers.
2. To study the working and function of mounting and accessories in boiler.
3. To study 2 stroke & 4 stroke diesel engine.
4. To study 2 stroke & 4 stroke petrol engine.
5. To study the vapour compression Refrigeration System and determination of its Coefficient of performance.
6. To study the functioning of Window Room Air Conditioner.
7. To calculate the Mechanical Advantage, Velocity Ratio and efficiency of Single start, Double start and Triple start worm wheel.
8. To calculate the Mechanical Advantage, Velocity Ratio and efficiency of Single Purchase, Double Purchase winch crabs and plot graphs.
9. To study Simple screw jacks and compound screw jacks and determine their efficiency.
10. To find the Mechanical Advantage, Velocity Ratio and efficiency of a Differential Wheel and Axle.
11. To perform tensile test, plot the stress- strain diagram and evaluate the tensile properties of a given metallic specimen.

Course Outcomes:

1. Understanding of Simple screw jacks and compound screw jacks
2. Calculate Mechanical Advantage, Velocity Ratio and efficiency of a Differential Wheel and Axle.
3. Understanding of working of 2 stroke & 4 stroke diesel engine and petrol engines.
4. Understanding of Cochran and Babcock and Wilcox boilers, mounting and accessories.
5. Calculate COP of refrigeration system and knowledge of air-conditioner.

B. TECH. I/II SEM

CODE: E-105

ELECTRICAL TECHNOLOGY (ET)

NO. OF CREDITS: 4

			SESSIONAL	: 40
L	T	P	THEORY EXAM	: 60
4	*0*	*0*	*TOTAL*	*: 100*

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

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

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

UNIT-III-

MAGNETIC CIRCUITS Magnetic Circuits, Magnetic Materials and their properties, static and dynamic emfs and force on current carrying conductor, AC operation of Magnetic Circuits, Hysteresis and Eddy current losses.

UNIT-IV

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-V-

AC CIRCUITS 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-VI

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-VII

ELECTRICAL MACHINES Introduction to transformer, DC machines, induction motor, synchronous machines; Principle, construction and working

COURSE OUTCOMES:

1 Analyze and solve AC & DC electric networks using different techniques.
2 An understanding of the construction and working principle of DC & AC machines.
3 Identify the type of electrical machines for a given application
4 An understanding of various types of measuring instruments.
5 An understanding of single phase and 3 phase systems.

Text Book:

1. Basic Electrical Engineering by Kothari & Nagrath TMH 2. Principle of electrical Engg. By V. Del Toro Printice Hall 3. Electrical Technology by B L Thereja S.Chand

B. TECH. I/II SEM

CODE: E-109

ELECTRICAL TECHNOLOGY LAB

NO. OF CREDITS: 1

L	T	P	Total
0	0	2	2

SESSIONAL	: 30
THEORY EXAM	: 20
TOTAL	*: 50*

1. To study various type of meters.
2. To verify KCL and KVL.
3. To verify Thevenin‘s theorem.
4. To Verify Maximum Power Transfer theorem.
5. To verify Superposition theorems.
6. To study frequency response of a series R-L-C circuit and determine resonant frequency& Q- factor for various values of R,L,C.
7. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q -Factor for various values of R,L,C.
8. To find inductance of coil without core and with U &I shape iron core.
9. To measure power and power factor in a 3-phase system by two wattmeter method.
10. To perform polarity test and find turn ratio of single phase transformer.

Course Outcome :

CO1 : Study and analyse Network Theorems
CO2: Understand frequency response of series and parallel R-L-C circuit
CO3: Study various types of meters
CO4: Understand to measure power and power factor in a 3-phase system.

B. TECH. I/II SEM

CODE: CE-101

Fundamentals of Computer & Programming with C

CREDITS: 4

		SESSIONAL:	40
L	P	THEORY EXAM:	60
4	0	TOTAL:	100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

Course Objectives

1. To understand the major components of computer system.
2. To learn about different Number Systems and their conversion.
3. To understand the types and functions of OS.
4. To learn about different programming languages and their corresponding Translators.
5. To learn about the basic concepts of Networking.
6. To understand the building blocks of C language like variables, data types, managing I/O etc.

UNIT-I :
AN OVERVIEW OF COMPUTER SYSTEM AND OPERATING SYSTEMS
Fundamentals: Evolution of computers, Hardware organization of a computer. Introduction to microprocessors, generation of microprocessors, commonly used CPUs. Input/Output Devices, Input/output ports and connectors.
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, Basic introduction to DOS, UNIX/LINUX OS, Windows XP, working with Windows.Introduction to computer viruses.

UNIT-II :
BASIC INTRODUCTION TO PROGRAMMING LANGUAGES
Machine Language, Assembly Languages, High level Languages, Types of high level languages, Complier, Interpreter, Assembler, Loader, Linker, Relationship between Compiler, Loader and Linker.

UNIT-III :
BASIC INTRODUCTION TO COMPUTER NETWORKS
Data Communication, modulation, Network devices, LAN, LAN topologies, WAN, OSI Reference model Introduction to Internet and protocols: TCP/IP ref. model, Backbone network, Network connecting devices. Hypertext documents, HTTP, DNS, Network Security.

UNIT-IV :
AN OVERVIEW OF C
Constants, Variables and Data types, operators and Expressions, managing I/O operations, Decision Making and branching, Decision Making and looping, Arrays, Character Arrays and Strings, User Defined Functions

UNIT-V :
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, size of structure.

UNIT-VI :
POINTERS IN C
Introduction, Understanding Pointers, Accessing the address of a variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a variable through its pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factors, pointers and Arrays, Pointer and Character Strings, Arrays of Pointers, Pointers as Function Arguments, Functions Returning Pointers, Pointers to Functions

UNIT-VII :
DYNAMIC MEMORY ALLOCATION AND FILE MANAGEMENT IN C
Introduction, Dynamic memory allocation, allocating a block of memory: Malloc, allocating multiple blocks of memory: Calloc. Releasing the used space: Free, Altering the size of block: Realloc, Defining and opening file, closing file, I/O operation on files, error handling during I/O operations, Random Access to files and command line arguments.

Course Outcomes

a. The students will understand computer system components in detail.
b. The students will know the types of format in which data can be stored in computer system's memory.
c. The students will be familiar with various types of OS and also compare them.
d. The students will be able understand various functions of OS
e. The students will be able to understand how with the help of translators computer understand human language.
f. The students will be able to understand and use the concept of networking in labs.

ELEMENTS OF ELECTRONICS ENGINEERING

E- 101

B. Tech. I / II Semester

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

Sessional: 40 Marks
Theory : 60 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course objective
Fundamental knowledge in electronic aspects will be provided in this course through the emphasis of basic active components, i.e. diodes, BJTs, Oscillators and Op-Amps. 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.

Part- A

SEMICONDUCTOR PHYSICS:
Basic concepts**,** Intrinsic and extrinsic semiconductors, diffusion and drift currents, p-n junction under open-circuit, reverse bias and forward-bias conditions, p-n junction in the breakdown region, Ideal diode, terminal characteristics of junction diode.

AMPLIFIERS:
Introduction of different types of amplifiers and their characteristics, Principle of amplification, Frequency response of RC coupled amplifiers, amplifier bandwidth and Concept of Cascaded Amplifiers, Feedback amplifiers, Effect of positive and negative feedback on amplifier gain and bandwidth**.**

Part-B

OSCILLATORS:
Criteria for oscillations, Qualitative analysis of LC, RC and Crystal Oscillators, Study of Wein Bridge Oscillators

OPERATIONAL AMPLIFIERS:
Op-amps, its characteristics and its applications.

POWER SUPPLIES
Introduction and Working of Switched Mode Power Supply (SMPS), Voltage Regulator, Introduction to Inverters and UPS.

Part-C

DIGITAL ELECTRONICS:
Binary, Octal and Hexadecimal number systems and conversions, Boolean Algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates, Difference between combinational circuits and sequential circuits, Introduction to flip-flops (S-R & J-K).

ELECTRONICS INSTRUMENTS:

Role, importance and applications of general-purpose test instruments vizMultimeter Digital & Analog, Cathode Ray Oscilloscope (CRO), Function/Signal Generator.

Part-D

DISPLAYS :
Seven segment display, Fourteen segment display, Dot matrix display

LED DISPLAY :
Introduction, Construction, Advantage of LEDs in electronics display

LCD DISPLAY :
Introduction; Types of LCD display:- Dynamic scattering and field effect type;

TYPES OF LIQUID CRYSTAL CELLS :
Transmitting type and reflective type; Advantage & disadvantage of LCD display common applications.

Books Recommended:

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).

Course Outcomes:

At the end of the program the students acquired knowledge about:

- basics of digital electronics.
- solving problems related to number systems and Boolean algebra.
- Various flip flops
- the semiconductors and diodes.
- Transistors, amplifiers and their applications
- the different types of oscillators
  operational amplifiers and their applications.
- Display devices like LCDs, LEDs, Seven segment and dot matrix display.

- Electronic instruments like CRO, function generator and multimeter etc.
- Power supply units like UPS, inverters etc..

REFERENCES

1. Fundamental of Information Technology by A.Leon&M.Leon.
2. UNIX Concepts and Application(4/e) by Sumitabha Das
3. Programming Languages (4th Edition) by Pratt IW
4. Fundamentals of Computers and Programming with C by A. K. Sharma Dhanpat Rai publications
5. Computer Networks (4th Edition) by Andrew S. Tanenbaum
6. Digital Principles and Application by Donald Peach, Albert Paul Malvino
7. Operating System Concepts, (6th Edition) by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne

MU- 201A STRENGTH OF MATERIALS –I

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 4	Sessional:	40 Marks
L T P Total	Theory:	60 Marks
4 0 0 4	Total :	100 Marks
	Duration of Exam:	3 Hours

Course Objectives:

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

Syllabus:

UNIT 1 **Simple Stresses & Strains:** Concept & types of Stresses and Strains, Poison'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, Numericals.

UNIT 2 **Compound Stresses & Strains**: Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses & strains and principal- planes, Mohr's circle of stresses, Numerical.

UNIT 3 **Shear Force & Bending Moment**: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contra-flexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Problems.

UNIT 4 **Torsion of Circular Members:** Torsion of thin circular tube, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust. Open coiled and closed coil helical spring, leaf springs, Numericals.

UNIT 5 **Bending & Shear Stresses in Beams**: Bending stresses in beams with derivation & application to beams of circular, rectangular, I,T and channel sections, composite beams, shear stresses in beams with combined bending, torsion & axial loading of beams. Numericals.

UNIT 6 **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, Numericals.

UNIT 7 **Slope & Deflection:** Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of

(i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numericals.

Course Outcomes (CO'S):

- Understand the effect of stresses and strain in combined loading.
- Calculate stresses and deflection in column and strut.
- To analyze various theories of failures.
- Understanding the effect of various loading in a compound bar.
- Analyze torsion in circular members.
- Analyze compound stesses.

Text Books

1. Strength of Materials – G.H.Ryder - Macmillan, India
2. Strength of Materials– Andrew Pytel and Fredinand L.Singer, Addison – Wesley

Reference Books

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials: A Rudimentary Approach – M.A. Jayaram, Sapna Book House, Bangalore

NPTEL Video Lecture ,Web: http://nptel.ac.in : Advanced strength of materials

MU-203A FLUID MECHANICS

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 4	Sessional	: 40 Marks
L T P Total	Theory	: 60 Marks
4 0 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Course Objectives:

To study various types of flow and flow measurement devices. To study about fluid kinematics, fluid dynamics, laminar and turbulent boundary layer flows, flow through channels and pipes.

Syllabus:

UNIT 1 **Introduction:** Fluid and flow definitions and types; Properties of fluids i.e. mass density, specific weight, specific gravity, viscosity etc.; Continuum; Pascal's Law; Hydrostatic Law; Manometry.

UNIT 2 **Fluid Statics:**; Forces on plane and curved surfaces; stability of floating and submerged bodies; Determination of metacentric height.

UNIT 3 **Fluid Kinematics:** Lagrangian & Eulerian approach; Classification of fluid flows; Flow lines; Continuity equation; Stream function; Potential function; Rotational flow rotation and vorticity; Flow Nets.

UNIT 4 **Fluid Dynamics:** Concept of system and control volume; Euler's equation; Bernoulli's equation; Derivation of Navier Stokes's equation; Momentum Principle, Venturimeter, orificemeter, Rotameter, Notches and Pitot tube.

UNIT 5 **Boundary layer Flow:** Boundary layer concept; Displacement; Momentum and Energy thickness; Von-Karman momentum integral equation; Laminar and Turbulent

boundary layer flows; Drag on a flat plate for laminar and turbulent flow; Boundary layer separation and control; Streamlined and bluff bodies; lift and drag on a cylinder and an airfoil.

UNIT 6 **Turbulent Flow:** Reynold's experiments; Prandtl mixing length hypothesis; Velocity distribution in pipes; Concept of smooth and rough pipes; Pipe friction factor relations.

UNIT 7 **Flow in Pipes:** Various losses in pipe line and their measurement; Hagen-Poiseuilli law; Total and Hydraulic gradient line; Pipes in series and parallel; Concept of equivalent pipe; Power transmission through pipes.

UNIT 8 **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.

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

- Understand the characteristics and properties of fluid along with pressure measurement techniques.
- Understand boundary layer theory.
- Analyze various losses in pipes.
- Analyze most economical channels.
- Understand the concept of laminar and turbulent flow.

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

NPTEL Video Lecture ,Web: http://nptel.ac.in, Fluid Flow

MU – 205A ENGINEERING MECHANICS

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 4	Sessional	: 40 Marks
L T P Total	Theory	: 60 Marks
4 0 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Course Objectives:

To study various concepts of particle kinematics, analysis of basic force system, To study about particle dynamics, general equation of equilibrium and methods of minimum potential energy.

Syllabus:

UNIT 1 **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, translation of a force to a parallel position, resultant of a force system, Problems (vector method).

UNIT 2 **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 3 **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 4 **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, inertia and coriolis forces. Problems (vector method).

UNIT 5 **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, linear and angular momentum equations for a systems of particles. Problems (vector method).

UNIT 6 **Variational Mechanics:** Hamiton principle, Lagrange equations, principle of virtual work, methods of minimum potential energy, stability.

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

- Understand the basic force system.
- Apply principles of particle kinematics.
- Grasp the concepts of particle dynamics.
- Understand general equations of equilibrium
- Understand methods of minimum potential energy.

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.

MU- 207A THERMODYNAMICS

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam. : 3Hours

Course Objectives:

To study essential concepts of energy, entropy and properties of steam. To study laws of thermodynamics, the fundamental concepts of thermodynamic relations and their application to solve engineering problems.

Syllabus:

UNIT 1. **Basic Concepts:** Macroscopic and Microscopic Approaches, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Properties – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes.

UNIT 2. **Pure Substances and their Properties:** Pure Substance and its Properties, Phase and Phase Transformation, Saturated and Superheat Steam, Triple point, T-V, P-V and P-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, separating and throttling calorimeter, Measurement of Dryness Fraction of Steam. Numerical Problems.

UNIT 3. **First Law of Thermodynamics:** Energy and its Forms, Energy and 1^{st} law of Thermodynamics, Internal Energy and Enthalpy, PMMFK, Steady Flow Energy Equation, 1^{st} Law Applied to Non- Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Numerical Problems.

UNIT 4. **Second Law of Thermodynamics:** Limitations of First Law, Thermal Reservoir, Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Plank and Clausius Statements and their Equivalence, PMMSK. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot Theorem and its Corollaries, Thermodynamic Temperature Scale.

UNIT 5. **Entropy**: Introduction, Clausius Inequality, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics. Numerical Problems.

UNIT 6. **Availability and Irreversibility:** High and Low Grade Energy, Available and Unavailable Energy, Loss of Available Energy due to Heat Transfer through a Finite Temperature Difference, Helmholtz and Gibb's Functions, Availability of a Closed System, Availability of a Steady Flow System, Dead State of a System, Effectiveness and Irreversibility, Second law efficiencies of Processes & Cycles. Numerical Problems.

UNIT 7. **Ideal and Real Gases:** Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avogadro's law and Universal Gas Constant, 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. Numerical Problems.

UNIT 8. **Thermodynamic Relations:** Maxwell Relations, Relations for changes in Enthalpy , Internal Energy & Entropy, Specific Heat Capacity Relations, Clapeyron Equation, Joule Thomson coefficient & Inversion Curve.

UNIT 9. **Renewable Energy:** Renewable Energy Scenario in India and around the World – Potentials – Achievements. Wind Energy, Bio-gas Plant. Fundamentals of Solar Power Generation: Photovoltaic Conversion, Solar Cells, Solar panels, Solar PV Power Generation set-up, applications.

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

- Understand the concepts of thermodynamic system, properties and equilibrium. State the gas laws and concepts of ideal and real gases.
- Understand zeroth, first and second laws of thermodynamics and apply them to solve various engineering problems.

- Calculate entropy and its changes for different processes and related problems.
- Define availability and unavailability for steady and unsteady flow processes.
- Understand the concept of irreversibility.
- Analyse the properties of steam and its plots on various property diagrams.

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

NPTEL Video Lecture ,Web: http://nptel.ac.in, Basic Thermodynamics

MU-209-A MANUFACTURING SCIENCE-I

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam. : 3Hours

Course Objectives:

To study essential concepts of metal casting procedure and welding methods. To study different manufacturing processes, powder manufacturing, compaction, sintering processes, various hot and cold extrusion processes.

Syllabus:

UNIT 1. **Metal Casting Processes**: Types of sand, sand material, procedure of mould, Patterns: Pattern materials, pattern allowances, types of pattern, color coding. Molding materials: Molding sand composition, sand preparation, sand properties and testing, Sand molding processes. Cores: Types of cores, core prints, chaplets, and chills. Gating systems: Gates and risers**,** Pit furnace, Melting practice: Cupola furnace, defects in castings and their remedies, Shell molding, precision investment casting, permanent mold casting, die casting, centrifugal casting, continuous casting.

UNIT 2. **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 3. **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 4. **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 5. **Powder Metallurgy & Plastics:** Powder manufacturing, compaction and sintering processes. Advantages and applications of Powder Metallurgy, Introduction, Raw material for plastics, Properties of plastics, types, Thermosetting plastics, Thermoplastics, Moulding compounds, Fabrication, machining and joining of plastics.

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

- Understand the process of metal casting.
- Understand different sheet metal operations.
- Understand different metal forming operations.
- Understand different welding processes.
- Understand powder metallurgy and plastic technology.
- Understand various hot and cold extrusion process.

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

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. Principle of Metal casting - Rosenthal, Tata McGraw Hill, New Delhi
4. Manufacturing Processes and Systems: Ostwald Phillip F., Munoz Jairo, John Wiley & Sons
5. Manufacturing Technology-Foundry, Forming and Welding - P.N. Rao, Tata McGraw Hill, New Delhi.
6. Elements of Manufacturing Processes – B.S. Nagendra Parasher, RK Mittal, PHI N. Delhi

MU- 211A STRENGTH OF MATERIALS LAB

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 1		Sessional:	30 Marks
L T P Total		Practical:	20 Marks
0 0 2 2		Total :	50 Marks

Course Objectives:

To enable the students to acquire the knowledge of hardness, tensile, compression, bending, impact test, shear test, torsion test and impact test. To draw shear force, bending moment diagrams for a simply supported beam under point and distributed loads.

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.

Course Outcomes (CO's): The student shall be able to:

- Able to perform various tests for checking hardness of material.
- Gain knowledge of different types of material testing procedure.
- Able to perform tensile, compression, bending, Ericson sheet metal and impact test.

- Able to draw shear force, bending moment diagrams for a simply supported beam under point and distributed Loads.

MU-213A FLUID MECHANICS LAB

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 1	Sessional : 30 Marks
L T P Total	Practical : 20 Marks
0 0 2 2	Total : 50 Marks

Course Objectives:
To enable the students to acquire the knowledge of fluid flow concept, fluid flow energy, stability of floating bodies and working principles of flow meters.

List of Experiments:

1. To determine coefficient of discharge of a Venturimeter.
2. To determine the coefficient of discharge of an Orificemeter.
3. To calibrate a Rotameter.
4. To determine the coefficient of discharge of a Notch (V and Rectangular types).
5. To determine the friction factor for the pipes.
6. To determine the coefficient of discharge, coefficient of contraction & coefficient of velocity for an orifice/mouthpiece.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends in the pipe line.
11. To verify the working of Pitot tube.

Course Outcomes (CO's): The student shall be able to:

- Gain knowledge of different form of energy of flowing fluid.
- Able to understand the concept of stability of floating bodies.
- Able to analysis the type of flow in pipes.
- Estimate major and minor losses in pipes.
- Understand the discharge measurement concepts in pipe flow and open channels.

MU- 215A COMPUTER AIDED DRAFTING LAB

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 1 — Sessional : 30 Marks

L T P Total — Practical : 20 Marks

0 0 2 2 — Total : 50 Marks

Duration of Exam. : 2 Hours

Course Objectives:

- To develop knowledge of different mechanical drafting softwares.
- To study drafting skills through CAE tools to produce expertise design engineers.

The students will be required to carry out the following exercises using educational softwares (AutoCAD-2007, Pro-Engineer etc).

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
2. Layout drawing of a building using different layer and line colors indicating all Building details. Name the details using text commands, Make a title Block.
3. To Draw Orthographic projection Drawings (Front view) of boiler safety valve giving name to the various components of the valve.
4. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.
5. To create the solid model of a cotter joint.
6. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
7. Prepare the 3D models like cone, cube, wedge etc. by extruding simple 2D objects, dimension and name the objects.
8. To model a spring by extruding a circle.

Course Outcomes (CO's): The student shall be able to:

- Understand the various CAE tools/softwares used for drafting.
- Use various drafting commands of CAE tools.
- Draft 2D & 3D modelling of mechanical components.

MU- 217A MACHINE DRAWING

B. Tech. (Mech. Engg.) III Semester

No. of Credits: 2	Sessional	: 40 Marks
L T P Total	Theory	: 60 Marks
0 0 4 4	Total	: 100 Marks
	Duration of Exam.	: 4 Hours

Course Objectives:

To study various concepts of orthographic and isometric projection. To study projection of points, planes, lines, solids , development of surface. To prepare assembly drawing with the bill of materials ,and study the concept of limits, fits and tolerances.

Syllabus:

PART-A

Unit 1: Introduction to BIS Specification SP:46 - 1988; Conventions of engineering drawing; Limits, fits and Tolerance: Introduction, basic terminology, International Tolerance (IT) grade, fundamental tolerances, unilateral and bilateral tolerances, placing a dimension with tolerance, cumulative tolerances, systems of fits, specifying a fit, types of fits, selection of fits

Unit 2: Gear: Basic gear terminology, I.S. convention representation of assembly of spur gears, helical gears, bevel gears, worm and worm wheel

PART-B

Unit 3: Orthographic views from isometric views of machine parts or components; Dimensioning; Sectioning; Coupling:Flange coupling and Flexible coupling; Pulley: Solid pulley, webbed pulley, fast and loose pulley, single and multi-belt groove pulley; Cotter joint: Sleeve and cotter joint, Spigot and socketjoint, Gib and cotter joint; Knuckle joint; Riveted Joints; Welded Joints

PART-C

Unit 4: Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing, Stop valve, Drill jig, Connecting rod.

NOTE:- (1) In the semester examination, the examiner will set total six questions in all, taking two questions from each part. The students will be required to attempt three questions in all, taking one question from each part.

(2) The questions from Part-A and Part-B will carry 15 marks each. Question from Part-C will carry 30 marks.

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

- Understand the basic principles of machine drawing assembly.
- Understand the concepts of limits, fits and tolerance.
- Understand and draw orthographic and isometric view of an object.
- Grasp the concepts of drawing various types of gears.
- Understand methods of assembly drawing with sectioning and bill of materials.

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, S K Kataria& Sons

Reference Books

1. Machine Drawing - A. Singh, Tata McGraw-Hill Education

2. Machine drawing – N. Sidheswar,P.Kannaiah,V.V.S. Sastry, Tata McGraw-Hill Education

MU – 202A KINEMATICS OF MACHINES

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 4

L	T	P	Total
4	0	0	4

Sessional: 40 Marks

Theory: 60 Marks

Total: 100 Marks

Duration of Exam: 3 hrs.

Course Objectives:

To Study relative motion between the various part of machine. To study the inversions of different types of kinematics chains , different straight line mechanism , different steering gears , different types of gears and analyze the simple gear train, compound gear train, reverted gear train and epicyclic gear train.

Syllabus:

UNIT 1. **Kinematics :** Mechanism and Machine, Links, Kinematic pairs, Degree of freedom, types of Kinematic Chain, Kinematic Inversions, Classification of Mechanism, Grashof's Law, Mechanical Advantage

UNIT 2. **Mechanisms with Lower Pairs:** Pantograph, Straight Line Mechanisms, Approximate Straight Line Motion Mechanism: Watt's Straight mechanism, Modified Scott-Russel Mechanism, Gross-Hopper Mechanism, Application of Straight Line Motion in Engine indicators: Simplex indicator, Crosby indicator, Thomson Indicator, Steering gears: Davis Steering gear, Ackermann Steering gear, Universal Hook's Joint.

UNIT 3. **Velocity and Acceleration in Mechanisms:** Instantaneous centre (IC) of rotation, application of IC method to determine velocities; Aronhold-kennedy theorem of three centres. Relative Velocity method to find out Velocities in four bar chain, slider crank chain, Klein's construction for velocity and Acceleration of piston, Acceleration of a body moving along circular path,

Acceleration diagram for a link and slider crank mechanism, Coriolis acceleration component, Rubbing velocity.

UNIT4 . **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 and analytical methods, Freudenstein's equation, precision positions, structural error; Chebychev spacing, transmission angle, problems.

UNIT 5. **Gears :** Classification of gears, Definition of terms used in gears, Law of gearing or condition for constant velocity ratio of gear wheels, 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 required on the pinion in order to avoid interference, Minimum number of teeth required on the wheel in order to avoid interference, Helical gears, spiral gears, expression for centre distance.

UNIT 6. **Gear Trains:** Types of gear trains: simple gear train, compound gear train, Reverted gear train, Epicyclic gear train, velocity ratio of gear train, Sun and planet gear, Torque and tooth loads in epicyclic gear train. Differntial Gear, Gear Box.

UNIT 7. **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, cam with specified contour.

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

- Analyse the relative motion between the various parts of machine.
- Develop the different types of mechanism.
- Understand the kinematics pair the different type and inversions of different kinematic chain.
- Understand working of different straight line mechanism
- Understand the working of gear and gear train.
- Understand the procedure find out the velocity of points in mechanism with relative velocity method and Instantaneous center method.

Text Books

1. Mechanical Engg. 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. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition – Addison Wisley Longman
4. Machine Design: S.G. Kulkarni, TMH, New Delhi.
5. Shigley and Mische, "Ntechanical Engineering Design", McGraw Hill, 1992
6. Robert, L. Mott, "Machine Elements in Mechanical Design", Macmillan Publishing Co., London, 1992
7. Sundararajamoorthy, T.V., and Shanmugam, N., "Machine Design", Khanna Publishers, Delhi, 2000
8. Maitra, G.M, "Handbook of Gear design", Tata McGraw Hill, 1988
   http://nptel.ac.in, NPTEL Vedio Lecture: Kinematics

MU- 204A STRENGTH OF MATERIALS-II

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 4	Sessional: 40Marks
L T P Total	Theory: 60Marks
4 0 0 4	Total : 100Marks
	Duration of Exam: 3Hours

Course Objectives:

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

Syllabus:

UNIT 1. **Strain Energy & Impact Loading:** 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 2. **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, Numericals.

UNIT 3. **Unsymmetrical Bending:** Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals.

UNIT 4. **Thin Walled Vessels:** Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire would cylinders, Numericals.

UNIT 5. **Thick Cylinders & Spheres:** Derivation of Lame's equations, radial & hoop stresses and strains in thick and compound cylinders and spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft, Numericals.

UNIT 6. **Rotating Rims & Discs:** Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (i) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals.

UNIT 7. **Bending of Curved Bars :** Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems.

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

- Understand the effect of applied load on the rigid bodies under various loading conditions.
- Calculate stresses and deflection by various strain energy methods on beams and shafts.
- To analyze various theories of failures.
- Understanding and designing of pressure vessels.
- Analyze stresses on curved beams and unsymmetrical beams and rotating rings and discs.

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.

Reference Books

1. Book of Solid Mechanics – Kazmi, Tata Mc Graw 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.

MU – 206A APPLIED THERMODYNAMICS

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 4	Sessional:	40Marks
L T P Total	Theory:	60Marks
4 0 0 4	Total:	100Marks
	Duration of Exam:	3 Hours

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.

Syllabus:

UNIT 1. **Fuels and Combustion:** Classification of fuels- solid, liquid & gaseous fuels, Combustion equations, Stochiometric air-fuel ratio, Excess air, Exhaust gas analysis, Orsat apparatus, Problems.

UNIT 2. **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 3. **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 4. **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 5. **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 6. **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 7. **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. Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytrophic efficiency, surging, choking and stalling, performance characteristics. Problems.

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

- Understand the concept of vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
- Learn about steam boilers, their types and components, their fuels and their performance.
- Learn about the fundamentals of flow of steam through a nozzle.
- Understand the working and types of steam turbines and can calculate their workdone and efficiencies.
- Understand the concepts, types and working of condensers and compressors and define their different types of efficiencies.

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

NPTEL Video Lecture ,Web: http://nptel.ac.in : Basic Thermodynamics

MU-208A FLUID MACHINES

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 4	Sessional	: 40 Marks
L T P Total	Theory	: 60 Marks
4 0 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Course Objectives:

To study various types of turbines, hydraulic machines, reciprocating and centrifugal pumps. To study about fluid machines like gear pump, hydraulic ram, intensifier, torque convertor etc.

Syllabus:

UNIT 1. **Impact of free jets:** Impulse – momentum principle; jet impingement - on a stationary flat plate; inclined plate and a hinged plate; at the center of a stationary vane; on a moving flat plate; inclined plate; a moving vane and a series of vanes; Jet striking tangentially at the tip of a stationary vane and moving vane(s); jet propulsion of ships. Problems

UNIT 2. **Impulse Turbines:** Classification – impulse and reaction turbines; water wheels; component parts; construction; operation and governing mechanism of a Pelton wheel; work done; effective head; available head and efficiency of a Pelton wheel; design aspects; speed ratio; flow ratio; jet ratio; number of jets; number of buckets and working proportions; Performance Characteristics; governing of impulse turbines. Problems

UNIT 3. **Francis Turbines:** Component parts; construction and operation of a Francis turbine; governing mechanism; work done by the turbine runner; working proportions and design parameters; slow; medium and fast runners; degree of

reaction; inward/outward flow reaction turbines; Performance Characteristics; Problems.

UNIT 4. **Propeller and Kaplan turbines:** Component parts; construction and operation of a Propeller; Kaplan turbine; differences between the Francis and Kaplan turbines; draft tube - its function and different forms; Performance Characteristics; Governing of reaction turbine; Introduction to new types of turbine; Deriaz (Diagonal); Bulb; Tubular turbines; Problems.

UNIT 5. **Centrifugal Pumps:** Classification; velocity vector diagrams and work done; manometric efficiency; vane shape; head capacity relationship and pump losses; pressure rise in impeller; minimum starting speed; design considerations; multi-stage pumps. Similarity relations and specific speed; net positive suction head; cavitation and maximum suction lift; performance characteristics; Brief introduction to axial flow; mixed flow and submersible pumps; Problems.

UNIT 6. **Reciprocating Pumps:** Construction and operational details; discharge coefficient; volumetric efficiency and slip; work and power input; effect of acceleration and friction on indicator diagram (pressure – stroke length plot); separation; air vessels and their utility; rate of flow into or from the air vessel; maximum speed of the rotating crank; characteristic curves; centrifugal V/S reciprocating pumps; brief introduction to screw; gear; vane and radial piston pumps; Problems.

UNIT 7. **Dimensional Analysis and Model Similitude:** Dimensional homogeneity; Rayleigh's method and Buckingham's π-theorem; model studies and similitude; dimensionless numbers and their significance. Unit quantities; specific speed and model relationships for turbines; dimensionless numbers; scale effect; cavitations – its causes; harmful effects and prevention; Thomas cavitation factor; permissible installation height; Problems.

UNIT 8. **Hydraulic systems:** Function; construction and operation of Hydraulic accumulator; hydraulic intensifier; hydraulic crane; hydraulic lift and hydraulic press; Fluid coupling and Torque converter; Hydraulic ram; Problems.

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

- Understand the concept of momentum and momentum equation, Euler's

fundamental equation and its applications.

- Understand the construction, working principle and design analysis of Hydraulic Turbines.
- Understand the construction, working principle and design analysis of Centrifugal Pumps.
- Understand the construction, working principle and performance characteristics of Reciprocating Pumps
- Know the working and application of different hydraulic machines.

Text Books

1. Hydraulics & Fluid Mechanics – Modi & Seth; Pub. - Standard Book House; N.Delhi
2. Hydraulic Machines – Jagdish Lal; Metropolitan

Reference Books

1. Fluid Mechanics and Hydraulic Machines – S S Rattan; Khanna Publishers
2. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas; Tata McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering – D S Kumar; S K Kataria and Sons

NPTEL Video Lecture ,Web: http://nptel.ac.in : Fluid Flow

MU- 210-A MATERIAL SCIENCE AND ENGINEERING

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 4	Sessional	: 40 Marks
L T P Total	Theory	: 60 Marks
4 0 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Course Objectives:

To study the structure of crystalline solids in materials, plastics, MMC, reinforced metal matrix composites, phase transformations and heat treatment of metals. To study economic, environmental, and societal issues in materials science and engineering.

Syllabus:

***UNIT 1*: The Structure of Crystalline Solids:** Introduction, Fundamental Concepts, Unit Cells, Metallic Crystal Structures, Density Computations, Polymorphism and Allotropy, Crystal Systems, Point Coordinates, Crystallographic Directions, Crystallographic Planes, Linear and Planar Densities, Close-Packed Crystal Structures, Single Crystals, Polycrystalline Materials, Anisotropy, X-Ray Diffraction for Determination of Crystal Structures, Imperfections in Solids, Point Defects, Impurities in Solids, Solid solutions, Linear Defects, Interfacial Defects, Bulk or Volume Defects.

***UNIT 2*: Dislocations and Strengthening Mechanisms:** Introduction, Characteristics of Dislocations, Slip Systems, Slip in Single Crystals, Plastic Deformation of Polycrystalline Materials, Deformation by Twinning, Strengthening by Grain Size Reduction, Solid-Solution Strengthening, Strain Hardening, Recovery, Recrystallization, Grain Growth.

***UNIT 3*: Failure:** Introduction, Fundamentals of 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 Behavior, Stress and Temperature Effects.

UNIT 4: **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 Alloys, Binary Eutectic Systems, Development of Microstructure in Eutectic Alloys, Eutectoid and Peritectic Reactions, The Iron–Iron Carbide ($Fe–Fe_3C$) Phase Diagram, Development of Microstructure in Iron–Carbon Alloys, The Influence of Other Alloying Elements in Steels.

UNIT 5**: Phase Transformations:** Introduction, Isothermal Transformation Diagrams, Continuous Cooling Transformation Diagrams, Mechanical Behavior of Iron–Carbon Alloys, Tempered Martensite, Review of Phase Transformations and Mechanical Properties for Iron–Carbon Alloys, Shape-Memory Alloys.

UNIT 6**: Diffusion and Heat Treatment:** Introduction, Diffusion Mechanisms, Steady-State Diffusion, Nonsteady-State Diffusion, Factors That Influence Diffusion, Introduction to case hardening, Thermal Processing of Metals: Annealing Processes, Heat Treatment of Steels, Precipitation Hardening.

UNIT 7**: Other Engineering Materials:** Introduction, Thermoplastic and Thermosetting Polymers, Copolymers, Polymer Crystallinity, Polymer Crystals, Ceramics and their Crystal Structures, 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.

UNIT 8**: 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.

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

- To analyse the structure of crystalline solids in materials.
- To understand fundamentals of ductile and brittle fracture.
- To understand characteristics of plastics, MMC and Reinforced composites.

- To understand economic, environmental, and societal issues in materials science and engineering.
- To understand dislocations concept and strengthening mechanisms.
- Understand phase transformations and heat treatment of metals.

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. Van Vlack, 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

MU-212A MANUFACTURING SCIENCE-II

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 4	Sessional	: 40 Marks
L T P Total	Theory	: 60 Marks
4 0 0 4	Total	: 100 Marks
	Duration of Exam.	: 3 Hours

Course Objectives:
To understand essential concepts of tool nomenclature, tool life and forces acting on the tools. To understand different machining processes , advance welding processes, manufacturing processes and machine tool testing.

Syllabus:

UNIT 1. **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 2. **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.

UNIT 3. **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 4. **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 5*. Unconventional Machining Processes**: Abrasive jet machining: Principles, applications, process parameters. Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications. Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications.

***UNIT 6*. Jigs & Fixtures:** Introduction, location and location devices, clamping and clamping devices, Drill Jigs, Milling Fixtures.

***UNIT 7*. Advance welding process:** 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 8*. Metrology & Machine Tools Testing**: Tolerances, limits and fits, methods of linear measurement and angular measurement, Go and No Go gauges. Introduction to Machine tools testing**,** measuring instruments used for testing, test procedures, acceptance tests of machine tools.

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

- Understand the nomenclature of the cutting tool, mechanism of cutting and different forces acting on the tools, tool life and tool wear.
- Analyze different cutting tool material and cutting fluid used for machining
- Analyse gear manufacturing methods and different types of jigs and fixtures used for production.
- Understand different modern machining processes and advance welding processes
- Understand different linear and angular measurement, machine tool testing

Text Books

1. Manufacturing Technology – Metal cutting and machine Tools: P.N. Rao, T.M.H, New Delhi

2. Introduction to Jig and Tool Design: Kempster M.H.A, Hodder & Stoughton, England

Reference Books

1. Principles of Machine Tools – G.C. Sen & A. Bhattacharya, Tata McGraw Hill, New Delhi
2. Manufacturing Engg. & Tech, Kalpakian, Serope Addison -Wisly Publishing Co. New York.
3. Modern Machining Processes: P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
4. Text Book of Production Engineering: P.C. Sharma, S.Chand & Sons.

MU – 214- A KINEMATICS OF MACHINES LAB

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 1	Sessional	: 30 Marks
L T P Total	Practical	: 20 Marks
0 0 2 2	Total	: 50 Marks

Course Objectives:

Kinematics of machines Lab is designed to develop the knowledge of geometrical aspects of motions of machine members and to carry out synthesis and analysis of mechanism.

List of Experiments:

1. To study various types of Kinematic links, pairs, chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, 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, bevel gear.
7. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
8. To study various types of cam and follower arrangement.
9. To plot follower displacement vs cam rotation for various cam follower systems

Course Outcomes (CO's): The student shall be able to:

1) Understand the various practical demonstrations of mechanism.
2) Understanding the Motions in mechanism with practical demonstration.
3) Learning the Special purpose machine members used in designing of a machine.
4) Synthesis of working model using the various linkages.

MU – 216-A APPLIED THERMODYNAMICS LAB

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 1	Sessional : 30 Marks
L T P Total	Practical : 20 Marks
0 0 2 2	Total : 50 Marks
	Duration of Exam. : 2 Hours

Course Objectives:

To understand essential concepts and practical side of flow of steam through steam boilers, steam turbines and condnsers. To learn about the concept and different components of vapour power cycles and find the related efficiencies.

List of Experiments:

1) To study low Pressure Boilers and their mountings & accessories
2) To evaluate high pressure boilers for different applications
3) To prepare the heat balance sheet for a given boiler
4) To analyse the working of Impulse and Impulse-Reaction steam turbine
5) To measure the dryness fraction of steam using throttling calorimeter
6) To evaluate condensers for various types of applications
7) To find volumetric efficiency of a reciprocating air compressor
8) To measure composition of a gas using Orsat apparatus
9) To find calorific value of a sample of fuel using Bomb calorimeter
10) To study the governing mechanism of steam turbines
11) To study the working of a thermal power plant
12) To find out the efficiency of cooling tower

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

- Learn about steam boilers, their types and components, their fuels and their performance.
- Understand the working and types of steam turbines with their comparision.
- Understand the concepts, types and working of condensers and compressors and define their different types of efficiencies.
- Learn about the fundamentals of flow of steam through a power plant.

MU-218-A FLUID MACHINES LAB

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 1	Sessional	: 30 Marks
L T P Total	Practical	: 20 Marks
0 0 2 2	Total	: 50 Marks

Course Objectives:
To enable the students to acquire the knowledge of fluid flow concept, working principles and analyze the performance of turbines, pumps and hydraulic ram.

List of Experiments:

1. To draw the layout of a Hydro power plant.
2. To analyze the impact of jet on the vanes.
3. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
4. To draw the performance characteristics of a Pelton turbine i.e. constant head, constant-speed and constant efficiency curves.
5. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
6. To draw the constant head, constant speed and constant efficiency performance characteristics of a Francis turbine.
7. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
8. To draw the constant head, constant speed and constant efficiency curves of a Kaplan turbine.
9. To study the constructional details and draw the characteristic curves of a Centrifugal Pump.
10. To study the constructional details and draw the characteristic curves of a Reciprocating Pump.
11. To study the construction details and draw performance curves of a Gear oil pump.
12. To analyze the constructional details of a Hydraulic Ram and determine its various efficiencies.

Course Outcomes (CO's): The student shall be able to:

- Able to know the working principle of turbines.
- Able to know the working principle of pumps.
- Able to draw performance curves of turbines.
- Able to draw performance cure of pumps.
- Analyze the performance of turbines and pumps.
- Understand the working principle and performance analysis of hydraulic ram.

MU- 220-A MATERIAL SCIENCE LAB

B. Tech. (Mech. Engg.) IV Semester

No. of Credits: 1	Sessional	: 30 Marks
L T P Total	Practical	: 20 Marks
0 0 2 2	Total	: 50 Marks

Course Objectives:

To acquire the knowledge of crystal structures and imperfections. To study preparation of specimen, optical microscope , microstructure of grey cast iron, mild steel/ aluminum and hardened steel specimen. To acquire the knowledge of hardening, tempering of metals and various types of plastics.

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.

Course Outcomes (CO's): The student shall:

- Understand crystal structure, imperfections and various types of plastics.
- Able to understand the principle and working of optical microscope.
- Able to analyze the microstructure of grey cast iron, mild steel and quenched hardened steel.
- Able to understand the process of hardening, tempering and annealing

MU-301-A DYNAMICS OF MACHINES

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	
Total : 100 Marks	Duration of Exam: 3 Hours

Course Objectives:

To study the forces acting on different links of mechanisms and the various forces for balancing of rotating and reciprocating masses. To study the different types of governors such as Watt governor,Proell governor, Hartnell governor and Wilson Hartnell governor. To study the effect of gyroscopic couple on stability of automotive vehicles.

Syllabus:

UNIT 1. **Static Force Analysis:** Equation of Equilibrium, Free body diagrams, Static force analysis of planer mechanisms; effect of sliding friction.

UNIT 2. **Inertia forces:** D-Alembert's Principle, compound pendulum, dynamically equivalent system, Inertia force analysis in a reciprocating engine with and without considering the mass of connecting rod.

UNIT 3. **Balancing of rotating masses:** Balancing of single rotating mass, Balancing of several masses rotating in the same plane, Balancing of several masses rotating in different planes.

UNIT 4. **Balancing of reciprocating masses:** Balancing of reciprocating engine, Partial balancing of primary force, Partial balancing of locomotives, Variation of tractive force, swaying couple, hammer blow, coupled locomotive, primary balance of multi-cylinder inline engine, Secondary balance of multi-cylinder in line engines, Method of direct and reverse cranks, V-engines balancing.

UNIT 5. **Governors: Types** of Governor, Watt Governor, Porter governor, Proell Governor, Hartnell Governor, Wilson-Hartnell governor, Sensitivity, Stability, Isochronism, Hunting, Governor Effort and Power, controlling force Diagram.

UNIT 6. **Gyroscopic effect and Gyroscope:** Spinning and precession, gyroscopic couple, Effect of gyroscopic couple on the stability of automotive vehicles: Stability of four wheelers, Stability of two wheelers, Gyroscopic effects on ships and aero planes.

UNIT 7. **Brakes and Dynamometers:** Types of brake: Simple shoe brake, Band Brake, Band and Block brake, Internal expanding shoe brake, Braking effect in vehicle, Vacuum brake, Dynamometer, Absorption Dynamometer: Prony brake dynamometer, Transmission Dynamometer: Epi-cyclic train dynamometer, Belt transmission dynamometer, Torsion dynamometer.

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

- Analyse the forces action on different members of mechanism.
- Analyse the magnitude of forces acting on different link of mechanism.
- Analyse the forces acting on reciprocating parts of engine.
- Analyse the various forces which play important role in balancing of rotating and reciprocating masses.
- Understand the governors to control the speed of different machines.
- Calculate the gyroscopic couple acting on ship, planes and automobiles.

Text Books

1. Mechanical Engg. 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. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition – Addison Wisley Longman
4. Machine Design: S.G. Kulkarni, TMH, New Delhi.
5. Shigley and Mische, "Ntechanical Engineering Design", McGraw Hill, 1992
6. Robert, L. Mott, "Machine Elements in Mechanical Design", Macmillan Publishing Co., London, 1992
7. Sundararajamoorthy, T.V., and Shanmugam, N., "Machine Design", Khanna Publishers, Delhi, 2000
8. Maitra, G.M, "Handbook of Gear design", Tata McGraw Hill, 1988

MUA- 303-A REFRIGERATION & AIR CONDITIONING

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 4		Sessional:	40 Marks
L T P Total		Theory:	60 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:

To study air refrigeration, vapour compression refrigeration, refrigerants, vapour absorption and steam jet refrigeration system. To study single stage and multistage and also cascade refrigeration for low temperature refrigeration. To study cooling and heating load and design of HVAC system.

Syllabus:

UNIT 1. **Introduction:** Definition , Methods of refrigeration, Industrial Refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants- Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants.

UNIT 2. **Air Refrigeration Systems:** Carnot refrigeration cycle. Temperature Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero-plane; 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 systems, problems.

UNIT 3. **Simple Vapour Compression (VC) Refrigeration Systems:** Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on P-V, T-S and P-H diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle, Ice plant, Problems.

UNIT 4 **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, Problems

UNIT 5 **Cascade Refrigerating Systems-**

Necessity Selection of Pairs of refrigerants for the system, Cascade temperature, Analysis, Multistaging, Comparison with V.C. systems, Manufacture of dry ice and supercritical CO2 cycle. Auto-cascade cycle. Introduction to Cryogenics, Applications. Problems.

UNIT 6. **Other Refrigeration Systems**

(A) Vapour Absorption Refrigeration Systems – Basic Systems, COP of the System, Performance, Properties of aqua ammonia; **Lithium bromide-Water Absorption Refrigeration Systems** and Electrolux Refrigeration system, Solar energy based absorption refrigeration systems .

(B) Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications.

UNIT 7. **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, expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems.

UNIT 8. **Air- Conditioning Load Calculations for design of RAC system :** 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; Apparatus selection; Duct systems design, ; Filters; Refrigerant piping, Comfort chart, cold storage , Problems.

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

- Understand the air refrigeration ,vapour compression refrigeration, different type of refrigerants, vapour absorption and steam jet refrigeration system.

- Understand working of understand single stage and multistage and also cascade refrigeration.
- Understand psychrometry and different Psychrometric process.
- Understand and evaluate cooling and heating load and design of HVAC system. .
- Develop and design RAC system and evaluate different expansion and control devices.

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.

MU-305-A INTERNAL COMBUSTION ENGINES

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 4		Sessional:	40 Marks
L T P Total		Theory:	60 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

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 pollution control system.

Syllabus:

UNIT 1. **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. Problems.

UNIT 2. **Carburetion, fuel Injection and Ignition systems:** Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, MPFI System, Requirements of a diesel injection system; types of injection systems; petrol injection, Requirements of ignition system; CRDI System, types of ignition systems ignition timing; spark plugs. Problems.

UNIT 3. **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 4*. 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, Thermostats Valve.

***UNIT 5.* Engine Testing and Performance:** 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; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems.

***UNIT 6.* Air pollution from I.C. Engine and Its remedies:** Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the blending of fuels, Bio Diesel, EURO- (1-4) series & BHARAT series, Current Scenario of Pollution on IC engine.

***UNIT 7*. Advancement of IC Engine:** Super charging, Turbocharging, Design of combustion chambers, Various tests for knocking, Engine tuning system, Trends of fuel saving ,Swirl Generation ,CNG and Hybrid Engines, Calibration of engines.

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

- Understand the Air Standard Cycles with their applications..
- Analyze carburetion, injection and injection system with new technologies.
- Understand Combustion System of IC Engines with Lubrication and Cooling system
- Understand the pollution control system
- Analyse the advancement in IC engines.

Text Books

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. 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.

MU- 307 MACHINE DESIGN -I

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **Materials:** Properties and IS coding of various materials, Selection of material from properties and economic aspects.

UNIT 2. **Design for Strength:** Allowable stresses, detailed discussion on factor of safety (factor of ignorance), Stress concentration- causes, Introduction of various design considerations like strength, stiffness, weight cost, space etc., Concept of fatigue failures.

UNIT 3. **Mechanical Joints:** Riveted Joints, Design of various types of welding joints under different static load conditions. Bolted joints in tension, Eccentrically loaded riveted, welded and bolted joints, Design of cotter and knuckle joints. Design of power screws and screw jack

UNIT 4. **Springs:** Design of helical springs, Design of leaf springs, Surging phenomenon in springs

UNIT 5. **Cylinders:** Design of thin and thick cylinders

UNIT 6. **Keys and Couplings:** Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid & Flexible coupling.

UNIT 7. **Clutches:** Various types of clutches in use, Design of friction clutches – Disc, Multidisc, Cone & Centrifugal, Torque transmitting capacity.

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

- Understand the material selection and selection of factor of safety.
- To understand the design of various types of springs.
- To understand the design of keys and coupling.
- To understand the concept of design of cylinders
- To understand the concept of design of mechanical joints.
- To understand the concept of design of clutches

Text Books

1. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.

2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

3. PSG Design Data Book

4. Design Data Book by M.L.Aggarwal, Jain Brothers,2013 Ed.

Reference Books

1. Engineering design – George Dieter, MGH, New York.

2. Product Design and Manufacturing, A.K.Chitale and R.C.Gupta, PHI.

3. Machine Design - An Integrated Approach: Robert L.Norton, Addison Wesley.

4. Machine Design: S.G. Kulkarini - Tata MacGraw Hill.

5. Design of machine elements-C S Sharma, Kamlesh Purohit, PHI.

MU- 309A NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **Numerical solution of algebraic and transcendential equations**: Bisection method, newton's method of false position, secant method, newton raphson method, iteration method

UNIT 2. **Solution of linear simultaneous equations**: Gauss elimination method, gauss jordon method, jacobi's iteration method, gauss siedal iteration method

UNIT 3. **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 4. **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 5. **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 6. **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

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

- Understand the errors and mathematical accuracy concepts
- To solve Numerical solution of partial differential equations
- To solve linear simultaneous equations
- To solve Numerical solution of ordinary differential equations
- To understand the concept of optimization.

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)

MU- 315A DYNAMICS OF MACHINES LAB

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 1	Sessional:	30 Marks
L T P Total	Practical:	20 Marks
0 0 2 2	Total:	50 Marks

Course Objectives:

Dynamics of machines lab will let the student to learn the effectiveness of various forces in the mechanism. The course gives the information about the specific mechanism like governor, gyroscope and various arrangements of cam and followers in terms of its features and operations. The course will enhance the analytical ability of the students while designing the various machine components/assemblies.

List of Experiments:

1. Carry out static balancing on static balancing machine.
2. Carry out dynamic balancing on dynamic balancing machine.
3. Determine the moment of inertia of connecting rod by tri-flair suspension pendulum.
4. Determine the moment of inertia of connecting rod by compound pendulum method.
5. Prepare performance characteristic Curves, and to find stability & sensitivity on Watt and Porter Governors.
6. Prepare performance characteristic curves, and to find stability & sensitivity on Proell Governor.
7. Prepare performance characteristic Curves on Hartnell Governor and find stability & sensitivity.
8. Study of gyroscopic effects through models.
9. Determine gyroscopic couple on Motorized Gyroscope.
10. Study of different types of brakes and dynamometers and finding out Brake power.

Course Outcomes (CO's): The student shall be able to:

1) Understand the various practical demonstrations of forces in mechanism.
2) Understanding the various Design features of mechanism with practical demonstration.
3) Learning the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine
4) Prepare practical model using the various linkages.

MU-317A REFRIGERATION & AIR CONDITIONING LAB

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 1		Sessional:	30 Marks
L T P Total		Practical:	20 Marks
0 0 2 2		Total:	50 Marks

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.

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.

Course outcomes:

The student shall be able to:

- Understand the vapour compression refrigeration system and vapour absorption system.
- Understand different compressors used in refrigeration system.
- Understand functioning of various control devices.
- Evaluate the COP of various refrigeration system such as vapour compression refrigeration system and vapour absorption system.
- Understand how the loading condition changes the COP of the system

MU – 319A INTERNAL COMBUSTION ENGINES LAB

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 1	Sessional	: 30 Marks
L T P Total	Practical	: 20 Marks
0 0 2 2	Total	: 50 Marks

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.

List of Experiments:

1. To analyze the constructional details & working principles of four stroke petrol/ diesel engine.
2. To analyze the constructional detail & working of two-stroke petrol/diesel 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 CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine by using gas analyzer.
7. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
8. To draw the scavenging characteristic curves of single cylinder petrol engine.
9. To study the construction and working of steam engine using its model.
10. To study the cooling system of an automobile.

Course Outcomes (CO's): The student shall be able to:

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

MU-302A COMPUTER AIDED DESIGN

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 4		Sessional:	40 Marks
L T P Total		Theory:	60 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:

To study essential concepts of computer aided design. To study modeling of curves, surfaces, transformations, solid modeling and representation of surfaces and application of CAD in mechanical engineering.

Syllabus:

UNIT 1. **Introduction**: Introduction to CAD/CAM, Historical developments, Industrial look at CAD/CAM, Comparison of CAD with traditional designing, Introduction to CIM; Basics of geometric and solid modeling, Packages for CAD/CAM/CAE/CAPP.

UNIT 2. **Transformations:** Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.

UNIT 3. **Modeling of Curves & Surfaces**: Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves. Plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, bezier surface, B-spline surfaces and their modeling techniques.

UNIT 4. **Solid Modeling:** Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition, spatial occupancy enumeration, coordinate systems for solid modeling.

UNIT 5. **Applications of CAD:** Introduction, Need and importance of solid and surface models for Interference detection, Assembly modeling, finite element analysis, computer aided part programming, computer aided process planning, Automated layout and drafting and computer aided manufacturing.

UNIT 6. **Automation and Numerical Control:** Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.

UNIT 7. **Group Technology:** Part families, part classification and coding, production flow analysis, Machine cell design, Advantages of GT.

UNIT 8. **Flexible Manufacturing Systems & Computer aided process planning**: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

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

- Understand the automation and flexible manufacturing systems.
- Develop transformations in 2D and 3D objects.
- Understand various applications of CAD such as computer aided part programming and computer aided process planning.
- Analyse part families and group technology.

Text Books

1. CAD/ CAM by Groover and Zimmer, Prentice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.

Reference Books

1 CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

MU- 304-A NUMERIC CONTROL OF MACHINE TOOLS AND ROBOTICS

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 4	Sessional:	40 Marks
L | T | P |Total	Theory:	60 Marks
4 | 0 | 0 | 4	Total:	100 Marks
	Duration of Exam:	3 Hours

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.

Syllabus:

Unit 1 **Numeric Control:** Introduction to numerical control, NC components, NC coordinate systems, Point to point, lined and contouring systems,open and close loop control system, Steps in NC manufacturing, Advantages, Disadvantages and Applications of NC, Trends and developments in NC, Role of NC/CNC technology in modern manufacturing, Features of CNC machining centre and CNC turning centre, Tooling for CNC systems, Automatic tool changer, Feedback devices: Encoders and linear scale

Unit 2 **NC programming**

Input media:Types of input media, punched tape, program tape composition and coding format, Tape reader and its types.

Part programming:Part programming fundamentals, Manual part programming, Part program composition, Preparatory functions, Miscellaneousfunctions, Tool length compensation, Canned cycles, Cutter radius compensation, Part programming for lathe, drilling and milling machines, Computer assisted part programming, Computer assisted part programming languages, CAD/CAM approach of programming

Unit 3 **Computer numerical control:**

Computer numerical control: Problems with conventional NC, Introduction to computer numerical control, Functions of CNC, Features of CNC, Difference between NC and CNC,Advantages, Disadvantages and Applications of CNC

Direct numerical control:Introduction, Components of a DNC system, Types of DNC, Functions of DNC, Advantages DNC

Distributed numerical control: Introduction, General configurations, Difference between direct and distributed numerical control

Adaptive control: Introduction, Sources of variability in machining, Types of adaptive control, Operation of an ACC system, Where to use adaptive control, Benefits of adaptive control machining

Unit 4 **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.

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

- Preparation of program for a punched tape for different coding formats
- Identify and understand the basic programming codes
- Develop part program for drilling, machining and turning operations
- Understand the basic concepts of numerical control, computer numerical control, direct numerical control, distributed numerical control and adaptive control systems
- Understand the basic physical configurations and technical features of a robot
- Understand various programming methods of robot

Text Books

1. CAD/CAM: computer-aided design and manufacturing - M. P. Groover, E. W. Zimmers, Prentice-Hall

2. Computer Aided Manufacturing - T. K. Kundra, Tata McGraw-Hill Education

Reference Books

1. Computer Control of Manufacturing Systems - Y. Koren, Tata McGraw-Hill Education

2. Automation, Production systems, and Computer-Integrated Manufacturing - M. P. Groover, Pearson Education

MU – 306A HEAT AND MASS TRANSFER

B.Tech.(Mech.Engg.) VI Semester

No. of Credits: 4		Sessional:	40 Marks
L | T | P |Total		Theory:	60 Marks
4 | 0 | 0 | 4		Total:	100 Marks
		Duration of Exam:	3 Hours

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).

Syllabus:

Unit 1 **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 2 **Conduction:**The thermal conductivity of solids, liquids and gases, factors influencing conductivity, measurement. The general differential equation of conduction One dimensional steady 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 3 **Convection (Forced):**Introduction, laminar boundary layer equations on a flat plate and in a tube, laminar forced convection on a flat plate and in a tube, simple Reynold's analogy, Dimensional analysis of forced convection, empirical relationship for forced convection.

Unit 4 **Convection (Natural):**Dimensional analysis of natural convection; empirical relationship for natural convection. Convection with phase change, Description of condensing flow. A theoretical model of condensing flow, Boiling heat transfer, Empirical relationships for convection with phase

Unit 5 **Heat Exchangers:**Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchange.

Unit 6 **Thermal Radiation:** Introduction, absorption and reflection of radiant energy, Emission, Radiosity and irradiation, Black and non black bodies, Kirchoff's law; intensity of radiation, radiation Exchange between black surface, geometric configuration factor, grey body relation exchange between surfaces of unit configuration factors. Grey body relation exchange between surfaces of unit configuration factors. Electrical analogy to simple problems.Non-luminous gas radiation.Errors in temperature measurement due to radiation.

Unit 7 **Introduction to Mass Transfer:**Mass and mole concentrations, molecular diffusion, eddy diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection Combined heat and mass transfer, the wet and dry thermometer.

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

- Understand the heat transfer that takes place in actual equipment like boilers, condensers, evaporators of power plants, refrigerators, air conditioners and heat exchangers used in chemical plants etc.
- Analyse and design the above equipment with some expert guidance.
- Understand the mass transfer in cooling towers etc.
- Design the cooling towers etc. with some expert guidance.

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

Reference 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

MU-308A MACHINE DESIGN – II

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **Fatigue consideration in design:** Variable load, Loading pattern. Endurance stresses; influence of size, surface finish, notch sensitivity & stress concentration. Goodmann line, Soderberg line; Design of machine members subjected to combined steady & alternating stresses. Design of finite life.

UNIT 2. **Shafts:** Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.

UNIT 3. **Design of gear tooth:** Lewis and Buckingham equations; wear and dynamic load consideration. Design & force analysis of spur, helical, bevel & worm gears. Bearing reactions due to gear tooth forces. Detailed design of the fixed ratio gear boxes

UNIT 4. **Design of sliding & journal bearing**, method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum films thickness & thermal equilibrium**.**

UNIT 5. **Design of fly wheels**: turning moment diagram, coefficient of fluctuation of energy and speed, design of solid and rimmed flywheel**.**

UNIT 6. **Design of miscellaneous components**: crane hook, C-clamp, machine frame etc, crank shaft and connecting rods.

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

- Understand the methods of fatigue design and finite life design.
- To understand the methods of design of shafts and flywheel.
- To understand the methods of design of various types of bearing.
- To analyze the effect of notch sensitivity & stress concentration in design.
- To understand the concept of design of crane hook, connecting rod, machine frame and other similar components.

Text Books

1. Mechanical Engg. 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. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition – Addison Wisley Longman
4. Machine Design: S.G. Kulkarni, TMH, New Delhi.
5. Shigley and Mische, "Ntechanical Engineering Design", McGraw Hill, 1992
6. Robert, L. Mott, "Machine Elements in Mechanical Design", Macmillan Publishing Co., London, 1992
7. Sundararajamoorthy, T.V., and Shanmugam, N., "Machine Design", Khanna Publishers, Delhi, 2000

MU- 310A INDUSTRIAL ENGINEERING

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 4		Sessional:	40 Marks
L T P Total		Theory:	60 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:

To study various concepts of industrial engineering in industries. To study various techniques such as material management, sales forecasting and information system structure in industries. Planning of new business structure.

Syllaus:

UNIT 1. **Basic Concepts of Industrial Engineering:** 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 2. **Productivity, Workforce & Information Management:** Productivity Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity, Various methods of Job evaluation & merit rating, Various incentive payment schemes, Organizational & information system structure,

UNIT 3. **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 4. **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 5. **Sales Forecasting:** Importance, Objectives, Forecasting and Prediction, Types, Classification of Forecasting Methods, Forecast Errors, Costs and Accuracy of Forecasts, Numerical Problems.

UNIT 6. **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.

UNIT 7. **Entrepreneurship :** Planning a New Business Venture, Small-scale Industries, Government Policies for Small-scale Industries, Project Identification and Project Formulation, Project Appraisal, Laws Concerning Entrepreneurs, Role of Various National and State Agencies that Render Assistance to Small-scale Industries.

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

- Learn various techniques of method study and work measurement.
- Understand factors affecting productivity and productivity improvement.
- Understanding the objective sequencing, effectiveness of production planning and control.
- Understanding sales forecasting and materials management techniques.
- Understanding the objective work study and method study
- Understanding micro motion study techniques

Text Books

1. Production & Operations Management – Chary, TMH, New Delhi.
2. Management Information Systems - Sadagopan, PHI New Delhi.

Reference Books

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

MU- 314A COMPUTER AIDED DESIGN LAB

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 1 — Sessional : 30 Marks
L T P Total — Practical : 20 Marks
0 0 2 2 — Total : 50 Marks
Duration of Exam. : 2 Hours

Course Objectives:

- To develop knowledge of different mechanical designing softwares.
- To impart designing skills through CAE tools to produce expertise design engineers.

The students will be required to carry out the following exercises using software packages (e.g. 3D modeling package/ Pro Engineer etc.).

CAD Modelling Assignments.

1. Construction of simple machine parts and components.
2. Modelling of machine components.

   • Diffuser section, Propeller.
   • Gear blank and other mechanical parts.
   • Mechanical assembly of parts.
3. Surface Modelling

   • Revolved surface like bottle surface.
   • Swept surface like air-conditioning duct.
   • Surfaces of solids like wedge, torus, cylinder etc.
4. Assembly Modeling

   • Assembly of piston cylinder, Gear trains, pedestal bearings etc.

Course Outcomes (CO's): The student shall be able to:

- Understand the various CAE tools/softwares used for designing.
- Use various drafting & analysis commands of CAE tools.
- Draft & analyze 3D modells of different mechanical components.

MU- 316A NUMERIC CONTROL OF MACHINE TOOLS & ROBOTICS LAB

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 1	Sessional : 30 Marks
L T P Total	Practical : 20 Marks
0 0 2 2	Total : 50 Marks

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.

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

Course outcomes:

The student shall be able to

- Identify different axes, machine zero, home position of CNC machines
- Identify and understand the basic programming codes of CNC
- Prepare part program for drilling, machining and turning operations on CNC machine
- Understand the programming method of robotic system
- Understand the working of an CNC and robotic system

MU- 318A HEAT AND MASS TRANSFER LAB

No. of Credits: 1 — Sessional: 30 Marks
L T P Total — Theory : 20 Marks
0 0 2 2 — Total : 50 Marks

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.

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 emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity 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 Stefen-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.

Course Outcomes (CO's): The student shall be able to:

- Understanding the conduction heat transfer coefficient.
- Design and analyze heat transfer system with practical demonstration.
- Selection of equipments and their practical demonstration in heat transfer design.
- Understanding development about mass transfer.

MU – 402A AUTOMOBILE ENGINEERING

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **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 2. **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 3. **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 4. **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 5. **Suspension Systems**: Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

UNIT 6. **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 7. **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 8. **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.

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

- Understand the principle of automobiles drive and advances in automobiles.
- To understand the concept of various types of clutch.
- Learn about various types of steering system along with merits and demerits.
- Understanding the various type of hybrid vehicles.
- Understanding the various types of brakes in automobiles.
- Development and understanding of hydrogen based technology for pollution control

Text Books

1. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

MU-404 A VIBRATIONS AND NOISE CONTROL

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 4		Sessional:	40 Marks
L T P Total		Theory:	60 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:

To study essential concepts for mechanical vibrations induced in various equipment.To study single degree of freedom, two degree of freedom system, vibration absorber and analyze effects of vibrations on mechanical equipment.

Syllabus:

UNIT 1. Introduction: Harmonic motion, periodic motion, vibration terminology.

UNIT 2. Single Degree of freedom Systems: Free and forced vibrations with and without damping, magnification factor, transmissibility and isolation.

UNIT 3. Two degree of Freedom Systems: Generalized co-ordinates, principal co-ordinates, derivation of equation of motion, co-ordinate coupling, Lagrange's equation.

UNIT 4. Vibration Absorber: Tuned absorber, determination of mass ratio, tuned and damped absorber (qualitative treatment only), untuned viscous damper.

UNIT 5. Multi Degree of Freedom system: Derivation of equation, calculation of natural frequencies by Rayleigh, Stodala, matrix, matrix iteration and Holzer methods.

UNIT 6. Vibration Analysis: Introduction, Influence coefficient, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes.

UNIT 7. Transient Vibrations: Impulse Excitation, Arbitrary Excitation, Response to step Excitation, Base Excitation Solution by Laplace Transforms, Response Spectrum, Runge- kutta Method.

UNIT 8 . Automotive Noise Control

Noise Characteristics of engines, Assessment of mechanical noise, Transmission noise. Control Techniques: Noise levels, Static and Dynamic Balancing, Methods of controlling noise in engines.

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

- Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom.

- To understand the concept of two degree of vibration and vibration isolation and transmissibility
- To analyse the normal modes in case of multi degree of freedom systems using various numerical methods
- Understanding the influence and stiffness coefficients
- Understanding the transient vibrations

Text Books:

1. Mechanical Vibration – V.P.Singh, Dhanpat Rai & Sons.
2. Mechanical Vibration : G.K.Grover – Nem Chand & Bros., Roorkee, INDIA

Reference Books:

1. Thomson, W.T, "Theory of Vibration with Applications", CBS Pub. & Distributors, 3rd Ed, 1988.
2. Tse, Morse and Hinkle, " Mechanical Vibration", prentice Hall of India Ltd, 1987
3. Schaum Outline Series, "Mechanical Vibration", Mc Graw Hill Book Company, 1990.
4. Lindley and Higgins, "Maintenance Engineering Hand Book" McGraw Hill Book Company, 1977.

MU- 406A OPERATIONS RESEARCH

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
4 0 0 4	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study the role of operational research in decision making. To study various types of model for operational research, design of simulation, waiting time model , transportation model-balanced & unbalanced & deterministic model.

Syllabus:

UNIT 1. **Introduction:** Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods.

UNIT 2. **Programming (LP):** Programming definition, formulation, solution- graphical, simplex Gauss-Jordan reduction process in simplex methods, BIG-M methods computational, problems.

UNIT 3. **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 4. **Advanced Topic Of LP:** Duality, PRIMAL-DUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post-optimality & sensitivity analysis, problems.

UNIT 5. **Waiting Line Models:** Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

UNIT 6. **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, optimal project cost by crashing of network, resources leveling in project, problems.

UNIT 7. **Simulation:** Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems.

UNIT 8. **Decision Theory:** Decision process, SIMON model, types of decision making environment - certainty, risk, uncertainty, decision making with utilities, problems.

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

- Formulate and design real-world problems through models & experiments.
- Understand the role of operations research in decision-making, and its applications in industry.
- Understand various types of deterministic and stochastic models like transportation model, waiting line model, project line model etc.
- Understand the relationship between a linear program and its dual and perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
- Design and simulate given processes to understand the real world situations

Text Books

1. Operation Research – TAHA, PHI, New Delhi.
2. Principle of Operations Research – Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.

Reference Books

1. Operation Research- Gupta & Sharma, National Publishers, New Delhi.
2. Quantitative Techniques- Vohra, TMH, New Delhi
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.

List of Discipline Elective Course

MU311A: Discipline Elective Course-1*

1. Product Design and Development - MU311A (1)
2. Air-Conditioning Equipments - MU311A (2)
3 Welding Technology- MU311A (3)
4. Machine Tool Technology- MU311A (4)
5. Power Plant Engineering- MU311A (5)
6. Metallurgy- MU311A (6)

MU312A :Discipline Elective Course-II*

1. Tooling for Production - MU312A (1)
2. Welding and Sheet metal Design and Drawing- MU312A (2)
3. Estimation and Design of RAC plants- MU312A (3)
4. Mechatronics- MU312A (4)
5. Flexible Manufacturing Systems- MU312A (5)
6. Design of Thermal Systems- MU312A (6)

MU408A:Discipline Elective Course-III*

1. Ergonomics and Workplace design - MU408A (1)
2. Project Management- MU408A (2)
3. Non-conventional Energy Resource Utilization- MU408A (3)
4. Management Information System- MU408A (4)
5. Concurrent Engineering- MU408A (5)
6. Management Science- MU408A (6)
7. Marketing Management- MU408A (7)

MU410A:Discipline Elective Course-IV*

1. Economics and Information Security - MU410A (1)
2. Metrology and Measurement- MU410A (2)
3. Plastics Mould Manufacturing - MU410A (3)
4. Robotic Engineering- MU410A (4)
5. Industrial Controls- MU410A (5)
6. Solid Waste - MU410A (6)

MU311A (1) PRODUCT DESIGN AND DEVELOPMENT

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts of product design and development. To design components for manufacture in industries, industrial design process and its management, product design methods, product specifications and product development.

Syllabus:

UNIT 1. **Introduction:** Design theory, design materials, human factors in design, man-machine system, applied ergonomics, characteristics of successful product development, challenges to product development.

UNIT 2. **Development process and product planning:** Generic development process, Concept development, product development process flows, product planning process, identify customer needs.

UNIT 3. **Product specifications and concept generation:** Product specification, steps to establish the target specifications, Concept generation, five step concept generation method, concept selection, concept screening, concept testing, product architecture

UNIT 4. **Product design methods**: Creative and rational, clarifying objectives - the objective tree method, establishing functions- the function analysis method, setting requirements – the performance specification method, determining characteristics – the QFD method, generating alternatives – morphological chart method, evaluating alternatives – the weighted objective method, improving details – the value engineering method and design strategies.

***UNIT 5*. Design for manufacture:** Estimating manufacturing cost, reducing component, assembly and support costs, design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective prototyping – principle and planning

***UNIT 6*. Industrial design:** Its need, impact and quality, industrial design process and its management, legal issues in product design, design resources, economics and management of product development projects.

***UNIT 7*. Prototyping:** Basics and principles of prototyping, prototyping technologies, planning for prototypes

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

- Understand the methods of product development.
- To understand the product concept generation and specifications.
- To understand the methods of industrial product design and prototyping.
- To understand the concept of design for manufacture.

Text Books

1. K.T. Ulrich and S.D. Eppinger, "Product design and development", Tata McGraw Hill
2. Chitale & Gupta, "Product Development", Tata McGraw Hill
3. Monks, J. G., "Operations Management", McGraw Hill, 1997.
4. George Dietor, A material and Processing approach, McGraw Hill

MU311A (2) AIR- CONDITIONING EQUIPMENTS

B.Tech.(Mech.Engg.) **V Semester**

No. of Credits: 3	Sessional:	40 Marks
L | T | P |Total	Theory:	60 Marks
3 | 0 | 0 | 3	Total:	100 Marks
	Duration of Exam:	3 Hours

Course Objectives:

To study concept of different type of filtering media for removal of dust and odour from the air and also addition and removal of moisture.To study different concept of heat transfer devices, expansion devices used in RAC. To study concept of Insulation, air distribution system and noise control in RAC system.

Syllabus:

UNIT 1. **Filters:** Air Cleaning, Air Filters, Methods of Air Cleaning, Dry Filters, Viscous Filters, Wet Filters, Electronic Filters, Centrifugal Dust Collectors, Odour Removal, Performance of air Filters. Humidifiers and Dehumidifiers, Steam Humidifiers, Atomization Type Humidifiers, Evaporative Humidifiers, Air Washers, Spray Type Dehumidifiers, Adsorbers.

UNIT 2. Types of Condensers, Cooling and Heating Coils: Shell and Tube type, Shell and Coil type, Pipe in Pipe, Electronic Heaters, Gas Fired Heaters, Oil Fired Heaters, Cooling Tower, Design analysis and selection of Cooling Tower.

UNIT 3. Types of Compressors, Compressor Performance curves, , scroll compressor, and variable drive compressor. Fans: Types, Axial Flow Fans, Centrifugal Fans, Fan Power, Efficiency, Fan characteristics, Selection of Fans. Types of Pumps, Power Required, Efficiency, Performance, Characteristics, Selection of a Pump.

UNIT 4. Evaporators types: Flooded and Dry Evaporators, Natural and forced convection type, Shell and Tube, Shell and Coil, Plate type, Secondary Evaporators, Temperature distribution and Heat flow in Evaporator, Pressure drop, Fouling correction factor.

UNIT 5. Expansion Devices, Capillary tube, Thermostatic Expansion valve, float valve, Electronic expansion valve, Solenoid control valve, Pipe design, General water piping, Refrigerant piping.

UNIT 6. Insulating material, Critical thickness for insulation, Relative humidity and insulation. Air distribution system, Ventilation system, Duct Design, Duct arrangement. Sources of Noise in Air conditioning system, methods of Noise control.

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

- Understand the construction and working principles of different type of filter s for dust and odour removal.
- Understand working of Humidifier, dehumidifier , Heating and cooling coils, cooling coils used in HVAC system
- Understand working of condenser, evaporators and cooling tower used in HVAC system.
- Understand working of Expansion and control devices used in HVAC system
- Understand air distribution system, Insulation and noise control in HVAC system.

Text Books

1. Carrier Hand Book for HVAC Engineers.
2. Refrigeration and Air Conditioning by C.P. Arora – TMH.
3. Refrigeration and Air Conditioning by S.C.Domkundwar – DhanpatRai& Sons.

MU311A (3) WELDING TECHNOLOGY

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 3		Sessional:	40 Marks
L T P	Total	Theory:	60 Marks
3 0 0	3	Total :	100 Marks
		Duration of Exam:	3 Hours

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.

Syllabus:

UNIT 1. **Oxy-Acetylene Welding:** Introduction: Welding processes and their principles, Industrial Applications, Principles of Oxy- Acetylene Welding, Procedure, Types of flames, Poping, 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 2. **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 3. **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. CO_2 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 4. **Computer systems for Welding Engg.:** Introduction, computer systems, software for welding engineers, magdata, weldcost, weldvol, distortcalc,cutbest,weldbest, ferritepredictor and weldselector.

UNIT 5. **Destructive and non 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. 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.

UNIT 6. **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.

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

- Principles and applications of oxyacetylene and electric arc welding.
- Understand various types of weld testing.
- Concept and techniques of welding automation.
- Methods of advanced and special welding processes.
- Computer system and software for welding engineers.

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.
3. Welding Engineering 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.

MU311A (4) MACHINE TOOL TECHNOLOGY

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

***UNIT 1*.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 2*.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 3*.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 4. **Installation of machine tools:** Location, lifting and unloading of machines, Equipments such as pulley blocks, Gantry, Derricks, Shear legs, Rollers and pinch bars. Slinging 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 5. **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 6. **Repair and Maintenance of Machine Tools:** Types of Maintenance, Break Down and Preventive Maintenance, Organization of Maintenance Deptt., Economic aspects of Preventive Maintenance, Restoration Techniques, Scraping, Babbiting, Use of Plastic Compound, Weld Deposition, Metalising**.**

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

- Understand principles and applications of oxyacetylene and electric arc welding.
- Understand various types of weld testing.
- Understand concept and techniques of welding automation.
- Analyse methods of advanced and special welding processes.
- Understand computer system and software for welding engineers.

Text Books

1. Machine Tool Technology by S.K.Gupta
2. Production Technology by P.C. Sharma – S.Chand & Co.
3. Industrial Maintenance by H.P.Garg – S.Chand & Co.
4. Production Technology by R.K.Jain - Khanna Publishers

MU311A (5) POWER PLANT ENGINEERING

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **Introduction:** Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

UNIT 2. **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 3. **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 4. **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 5. **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 6. **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-out put curves, efficiency, heat rate, economic load sharing, Problems.

UNIT 7. **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 8. **Direct Energy Conversion Systems:** Fuel cell, MHD power generation-principle, open & closed cycles systems, thermoelectric power generation, thermionic power generation.

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

- Understand the principles of steam power plants and gas power plants.
- Utility and applications of nuclear power plant.
- Installation and commissioning of hydro-electric power plants.
- Understand various factors affecting non-conventional power plant.
- Understanding about different types of power plants
- Analyse pollution emission and their effect on environment

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.

MU311A (6) METALLURGY

B. Tech. (Mech. Engg.) V Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **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 2. **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 3. **Iron - Carbon System:** Iron, Allotrophy, 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 4. **Metallography:** Introduction and Definition, Metallurgical Microscope, Preparation of Specimen, Micro and Macro Examination, Electron Microscope

UNIT 5. **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. Pyrometers, Optical Pyrometer, Radiation Pyrometer and Other Methods of Indicating Temperature

UNIT 6. **Case Hardening and Surface Treatment:** Carburizing, Pack Carburizing, Gas Carburizing, Nitriding, Cyaniding, Flame Hardening, Induction Hardening

UNIT 7. **Failure Analysis:** Fracture, Types of Fracture, Brittle Fracture, Ductile Fracture, Mechanism of Fracture, Fatigue :- Introduction, Fatigue Limit, Mechanism of Fatigue, Creep, Creep Curve, Low Temperature and High Temperature Creep, Transient and Viscous Creep, Mechanism of Creep

UNIT 8. **Non Destructive Testing of Metals:** Non Destructive Tests Such as Radiography, Ultrasonic Inspection, Magnetic Particle Inspection, Flourescent Penatrant Inspection.

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

- Understand the types of solid solution and phase diagram.
- Develop utility and applications of metallography.
- Understanding the mechanism of fracture.
- Understand heat treatment process and various factors affecting the heat treatment process.

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

MU312A (1) TOOLING FOR PRODUCTION

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study various design of cutting tools for production. To study various gauges ,jigs and fixtures for production, press tools like bending, forming, drawing, moulds for plastic and die casting.

Syllabus:

UNIT 1. **Design of cutting tools:** Design of single point Turning Tool, Tool signature, Design features for Twist Drill, Milling Cutters, Cutting Tool materials.

UNIT 2. **Gauges and Gauges Design:** Design of Plug Gauges and Ring Gauges, Standards, Design of Flush Pin Gauges, Indicating Gauges, Functional Gauges, Operation of Air Gauge.

UNIT 3. **Jigs and Fixtures:** Advantages for Jigs and Fixtures, Elements of Jigs and Fixtures, Principle of location, locating devices, clamping devices, Types of Drill Jigs, Template Jig, Plate Jig, Box Jig and indexing Jig, Examples of Milling Fixtures, Design considerations for Jigs and Fixtures.

UNIT 4. **Design of Press Tools:** 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 5. **Design of Bending, Forming and Drawing Tools:** Bending operation, Spring back, Design features for Bending Die, Forming Die, Draw calculations, Draw Tool parts, Design features.

UNIT 6. **Moulds for Plastic and Die Casting:** Common Types of Plastics, Simple Injection Moulding Tool details, Compression Mould and Transfer Mould Arrangements. Die for Cold Chamber Die Casting.

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

- Understand the various design of cutting tools.
- Understand applications of jigs and fixture for production.
- Understanding the mechanism of press tools like bending,forming,drawing,etc.
- Develop moulds for plastic and die casting.

Text Books

1. Fundamentals of Tool Design – Donaldson - TMH
2. Theory of Metal Cutting and Tool Design – Arshinov – Mir Publishers, Moscow.
3. Fundamentals of Tool Design- ASTME
4. Tool Design- H.W, Pollack - Tarapouevala
5. Jigs and fixtures - P. B. Joshi – McGraw Hill
6. An introduction to Jigs and Fixtures- M.HA Kempster – Whitaker & Sons Ltd.

MU312A (2) WELDING AND SHEET METAL DESIGN AND DRAWING

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 3		Sessional:	40 Marks
L T P	Total	Theory:	60 Marks
3 0 0	3	Total :	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:

To study various types of welded design . To study cost estimation, economics of welding ,riveted joints, design of thick and thin cylinder, pressure vessel,design of punches and die .

UNIT 1. **Design of Welded Joints:** Joints subjected to Tensile and Compressive stress, Single and Double "V" groove Butt Joint, Transverse Fillet Joints, Parallel Fillet Joints, Joints subjected to Torsion:-Circular Fillet Weld, Long Adjacent Fillet Weld. Welded Joints subjected to Varying Loads:-Spot Welded Joints, Welding Symbols.

UNIT 2. **Design of Rivetted Joints:** Design of Structural Rivetted Joints.-Failure of Rivetted Joints, Calculation of Strength and Efficiency of Joints with Eccentric Loading, Design of Lozenge Joints:-Calculation of Rivet Diameter, Number of Rivets, Their Arrangement, Strap thickness, Efficiency of the Joint

UNIT 3. **Design of Pressure Vessels:** Cylindrical, Spherical and Dished End Shells, Design of Pipes, Design Considerations in Pressure Vessels.

UNIT 4. **Design of Thick and Compound Hydraulic Cylinders**

UNIT 5. **Design of Punches and Die for Sheet metal work :** Punch and Die sizes for Punching and Blanking, Shearing force for Punching and Blanking, Center of Pressure, Blanking Layout, Design of Blanking Tool, Piercing Tool and Progressive Tool for simple component like Washer.

UNIT 6. **Cost Estimation and Economics of Welding:** Cost Elements of a Welded Job-Material Cost, Fabrication Cost, Preparation Cost, Welding Cost, Finishing Cost and Overhead Cost, Economy in Preparation and Welding a Job-Labour Accomplishment Factor, Cumulative effect of Poor Practices on Cost, Cost Calculation of a Welded Job, Uses of Jigs and Fixtures and Weld Gauges.

UNIT 7. **Prediction and Control of Distortion:** Calculation of Longitudinal Contraction, Transverse Contraction, Angular Contraction due to Single Weld Pass, Good Practice in Fracture Safe Design, Practical Approach to Fatigue Safe Design.

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

- Understand the various welded design.
- Utility and applications of welding in thin and thick pressure vessel..
- Understanding the mechanism of punches and die in sheet metal work.
- Understand cost estimation and economics of welding.

Text Books

1. ISI HandBook for Manual Metal Welding for Welders.
2. Fundamentals of Tool Design - Donaldson - TMH
3. Fundamentals of Tool Design - ASTME
4. Tool Design - H.W. Pollack - Tarapouevala
5. Jigs and fixtures - P.B Joshi - MCH
6. Fundamentals of Machine Design - Juvinall – Richard Dennis Publishers
7. Machine Design - Pandya and Shah – Charotar Publishing Co.

MU312A (3) ESTIMATION AND DESIGN OF RAC PLANTS

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 3		Sessional:	40 Marks
L T P	Total	Theory:	60 Marks
3 0 0	3	Total :	100 Marks
		Duration of Exam:	3 Hours

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.

Syllabus:

UNIT 1. **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 2. **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 3. **Air Duct Design :**Pressure changes, Friction Losses, Continuity Equation, Darcy Formula, Circular equivalent of Rectangular Ducts, Dynamic Loses, 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 4. **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 5. **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 6. **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.

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

- Understand the heat load estimation of air-conditioning system.
- Understand general procedure of piping design in air-conditioning systems.
- Analyse cold storage system and ice making requirements of system.
- Understand air space ducting and duct design in air-conditioning system.
- Design and development refrigeration system
- Develop refrigeration system improvement.

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.

MU312A (4) MECHATRONICS

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts of various actuation system . To study concept and interfacing of various hardware in mechatronics design of mechanical products. To study control system for effective functioning of mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.

Syllabus:

UNIT 1. **Introduction and Basics:** What is Mechatronics?; A Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers; The Mechatronic Approach.

UNIT 2. **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 Acqusition; Digital Signal Processing; Pulse Modulation; Data Presentation Systems – Displays; Data Presentation Elements; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems.

UNIT 3. **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 4. **System Modeling and Performance:** Engg. 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 5. **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; Adaptative Control; Problems.

UNIT 6. **Digital Logic and Programmable Logic Controllers :** A Review of Number Systems & Logic Gates; Boolean Algebra; Kanaugh 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 7. **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.

UNIT 8. **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.

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

- Generate conceptual design for Mechatronics products based on potential custom requirements
- Select appropriate sensors and actuators.
- Design a control system for effective functioning of Mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC
- Develop system model for mechanical system
- Understand hardware tools to build mechatronics system

Text Books

1. Mechatronics by W. Bolton, Published by Addition 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

MU312A (5) FLEXIBLE MANUFACTURING SYSTEMS

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study various techniques for automation and automated assembly. To study concept and interfacing of various hardware and software for automation of mechanical products. To study flexible manufacturing system and control strategies.

Syllabus:

UNIT 1 **Automation:** Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations.

UNIT 2. **Automated Assembly Systems:** Design for automated assembly, types of automated assembly systems, part feeding devices, quantitative analysis of the delivery system operation, analysis of a single-station assembly machine, numericals.

UNIT 3. **Group Technology:** 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, benefits of group technology.

UNIT 4. **Flexible Manufacturing Systems:** Components of an FMS, types of systems, where to apply FMS technology, FMS work stations. Material handling

and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment. Computer control system: Computer function, FMS data file, system reports. Planning the FMS, analysis methods for FMS, applications and benefits.

UNIT 5. **Robotic Technology:** Joints and links, common robot configurations, work volume, types of robot control, accuracy and repeatability, other specifications, end effectors, sensors in robotics.

UNIT 6. **Robot Programming:** Types of programming, lead through programming, motion Programming, interlocks, advantages and disadvantages. Robot languages: Motion programming, simulation and off-line programming, work cell control.

UNIT 7. **Robot Applications:** Characteristics of robot applications, robot cell design, types of robot applications: Material handling, processing operations, assembly and inspection.

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

- Understand the procedure of manufacturing automation.
- Analyze automated assembly in manufacturing.
- Understand knowledge of types of robot and robot applications.
- To be expertise of robot programming
- Understand a flexible manufacturing system and control strategies.
- Develop best machine arrangement using GT.

Text Books

1. Automation, Production Systems and Computer Integrated Manufacturing- Groover M.P, Prentice Hall of India.
2. CAD/CAM – Groover M.P, Zimmers E.W, Prentice Hall of India.

Reference Books

1. Approach to Computer Integrated Design and Manufacturing: Nanua Singh, John Wiley and Sons, 1998.
2. Production Management Systems: A CIM Perspective- Browne J, Harhen J, Shivnan J, Addison Wesley, 2nd Ed. 1996.

MU312A (6) DESIGN OF THERMAL SYSTEMS

B. Tech. (Mech. Engg.) VI Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

UNIT 1. **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 2. **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 3. **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 4. **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 5. **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.

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

- Understand the heat load estimation of air-conditioning system.
- General procedure of heat exchanger design in air-conditioning systems.
- Complete analysis of vapor compression refrigeration system.
- Environmental consideration in design of thermal systems.
- Understanding about the thermodynamics of the refrigeration systems
- Design of thermal systems

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 - Butterwouth.
5. Heating, Ventilating and Air Conditioning - By Mc Quistion, 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 condioning - By P.L.Ballaney - Khanna Publishers.

MU408A (1) ERGONOMICS AND WORK PLACE DESIGN

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:
To study various concepts of ergonomics and application in mechanical engineering. To study human error and risk in product design and manufacturing. To study methods of questionnaire in design and assessment.

Syllabus:

UNIT 1. **Basic Principles of Ergonomics**: Anthropometry, Posture and Health; Anthropometry Practical; Displays, Controls and HMI; Tools and Equipment Design; Workplace Design and Assessment; Task Analysis; Questionnaire and Interview Design; Product Design and Evaluation; Designing for manufacture and maintenance; Health and Safety Legislation and Ergonomics.

UNIT 2. **Application of Ergonomics:** Principles, Cognitive Ergonomics, Human Information Processing; Memory; Reading; Perception; Navigation; Problem Solving; Decision Making, Human-Computer Interaction, Input/Output Technology, Usability; Evaluation; Health problems.

UNIT 3. **Future Systems**: Job Design, Scientific Management, Enrichment, *Enlargement, Rotation, Cells, Shift work, Management Style and Job* Design, Change Management. New Technology, Unemployment, Deskilling, Introducing new technology. Questionnaire design and assessment. Task analysis techniques. Measurement of human error and risk. Use of simulation and prototypes. Product Evaluation. Experimental Design.

UNIT 4. **Case Studies**: A set of case studies will be used to demonstrate how ergonomics has lead to changes in work activity, safety and product design. Case studies will include advanced computer applications, workplace assessment and re-design, accident analysis and industrial inspection, and in manufacturing. Students will be required to apply the principles to a real life ergonomic design as applied to a product, service or computer application.

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

- Understand the basic principles of new technology ergonomics in mechanical engineering.
- Understand the applications of ergonomics in product design, manufacturing and maintenance.
- Understand the concept of measurement of human error and risk in product design an manufacturing.
- Develop the concepts of ergonomics in engineering.
- Understand methods of questionnaire in design and assessment.

Text Books

1. Work Design: Industrial Ergonomics – Knoz, Stephan A., Johnson, Steven, Holcomb Hathaway, Scottsdale, AZ.
2. Human factors in engineering and design – Sanders, M.S. & McCormick, E.J., 6th ed., McGraw-Hill, New York.

Reference Books

1. Ergonomics: Man in his working environment- Murrell, K.F.H, Champan & Hall, London.
2. Man – Machine Engineering – Chapanis A: Wordsworth Publishing Co.
3. The Practice and Management of Industrial Ergonomics – Alexander, D.C., Prentice-Hall, Englewood Cliffs, NJ.
4. Textbook of Work Physiology – Astrand, P.O. & Rhodahl, K.– McGraw-Hill, New York.
5. Human Factors in Lighting – Boyce, P.R. Macmillan, New York.
6. The Ergonomics of Workspaces and Machines: A design manual – Clark, T.S. & Corlett, E.N. Taylor & Francis, London.
7. Ergonomics at work. Oborne, D Wiley, London.
8. Bodyspace–Anthropometry, Ergonomics and Design. – Pheasant, S. Taylor & Francis

MU408A (2) PROJECT MANAGEMENT

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 3		Sessional:	40 Marks
L T P Total		Theory:	60 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Course Objectives:
To study develop project within time, resource & budget. To study project execution with strategies. To study types of projects, project life cycle, identify project issues ,development of project network ,CPM and PERT.

Syllabus:

UNIT 1.**Introduction & Overview**: Definitions, Types of projects, Project life cycle (Project phases) and decisions.

UNIT 2. **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 3. **Development of Project Network**: Project description, Work break down structure, Nomenclature, Rules for drawing and representation, consistency and Redundancy in Project Networks, Matrix representation.

UNIT 4. **Basic Scheduling with Networks** (Forward & Backward Pass)

UNIT 5. **CPM & PERT**: Activity times, Completion, Floats, Probability (ND usage), Examples, and Problems.

UNIT 6. **Project Monitoring & Control**: Project adjustments, Crashing: Direct & Indirect cost, Normal & Crash: duration & cost, Resource leveling: Types, usage, leveling, Problems, Managing Risk.

UNIT 7. **Role of Human Factors**: Dealing with people Team Building and Leadership in Projects, commitment, work culture, motivation, coordination, attitude, innovation.

UNIT 8. **Project Completion,** Review and Future Directions

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

- Understand about the types of projects and project appraisal & selection.
- Complete understanding about development of project network.
- Understanding the role of human factors in a project.
- Understand Project evaluation & review technique (PERT) & Critical path method (CPM).
- Understand how to control & monitor a project.

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.

MU408A (3) NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

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.

Syllabus:

UNIT 1. **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.

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 2. **Solar energy:** Solar thermal power and it's 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 3. **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.

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 4 **. Electrochemical effects and fuel cells:** Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells .

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 5. **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, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

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

- Understand about the types of energy resources and energy requirement.
- Complete understanding about production and utility of bio-gas and wind energy.
- Understanding the utility of solar energy.
- Understanding the project evaluation & review technique (PERT) & critical path method (CPM).
- Understanding tidal and wave energy as alternate resource .

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.

MU408A (4) MANAGEMENT INFORMATION SYSTEM

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study about various concepts of management information system. To Study about business application of information system ,enterprise & global management, security & ethical challenges.

Syllabus:

UNIT 1. **Organisation & Types**, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, various channels of information & MIS.

UNIT 2. **Foundation of Information System**: Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS- dataflow diagram, flow chart etc.

UNIT 3. **Business application of information technology**: electronic commerce Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage.

UNIT 4. **Managing Information Technology**, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools.

***UNIT 5*. Advanced concepts in information system**: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, Procurement**,** Management System Object Oriented modeling case studies.

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

- Understand about managing the information system.
- Understanding about organization of information system.
- Understand knowledge of application of business information system.
- Understanding about the enterprise resource planning.
- Solving business problems with information system .

Reference & Text Books

1. O.Brian, "Introduction to Information System", McGraw Hill.
2. O.Brian, "Management Information System", TMH.
3. Alter, "Information Systems: A Management Perspective", Addison Wesley.
4. Arora & Bhatia, "Information Systems for Managers", Excel
5. Bansal, "Information System Analysis & Design", TMH.
6. Jawadegar, "Management Information System", TMH.
7. Murdick, "Information System for Modern Management", PHI.
8. Alexis Leon, "Enterprise Resource Planning", TMH.

MU408A (5) CONCURRENT ENGINEERING

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study about various techniques of concurrent engineering. To Study about quality in design. To study about design and manufacturing strategies, quality engineering & methodology for robust product.

Syllabus:

UNIT 1. **Introduction:** Background and challenges faced by modern production environment, sequential engineering process, Concurrent engineering definition and requirement, meaning of concurrent objectives of CE, benefits of CE, Life cycle design of products, life cycle costs. **Support for CE:** Classes of support for CE activity, CE organizational, structure CE, team composition and duties, Computer based Support, CE Implementation Process.

UNIT 2. **Design Product for Customer:** Industrial Design, Quality Function Deployment, house of quality, Translation process of quality function deployment (QFD). **Modeling of Concurrent Engineering Design:** Compatibility approach, Compatibility index, implementation of the Compatibility model, integrating the compatibility Concerns.

UNIT 3. **Design for Manufacture (DFM):** Introduction, role of DFM in CE, DFM methods, e.g. value engineering, DFM guidelines, design for assembly, creative design methods, product family themes, design axioms, Taguchi design methods, Computer based approach to DFM. Evaluation

of manufacturability and assemblability.

UNIT 4. **Quality by Design :** Quality engineering & methodology for robust product design, parameter and Tolerance design, Quality loss function and signal to noise ratio for designing the quality, experimental approach.

UNIT 5. **Design for X-ability:** Design for reliability, life cycle serviceability design, design for maintainability, design for economics, decomposition in concurrent design, concurrent design case studies.

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

- Understand about design and manufacturing concepts.
- Understanding about quality in design.
- Understand about the organization of concurrent engineering.
- Understanding about the designing a product for a customer.
- Usage of Modeling of Concurrent Engineering Design.

Text Books

1. Concurrent Engineering- Kusiak - John Wiley & Sons
2. Concurrent Engineering- Menon - Chapman & Hall

MU408A (6) MANAGEMENT SCIENCE

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 3	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study about management functions. To Study about Organization system. To study about different Management techniques, planning, organising, staffing, directing and controlling of human resource.

Syllabus:

Management Concepts: Meaning of Management, Definitions of Management, Characteristic of Management, Management Vs Administration, Management-Art, Science and Profession, Importance of Management, Development of Management Thoughts, Principles of Management, The Management Functions, Inter-relationship of Managerial Functions, Ethics in management, Social Factors, Unfair and Restrictive Trade Practices.

UNIT 1. **Planning, Organising, Staffing, Directing and Controlling:** Nature, Purpose and Objectives of Planning, Nature and Purpose of organising, Organisation Structure, Authority and Responsibility, Nature and Significance of staffing, Performance Appraisal, Nature, Principles and Techniques of Directing, Nature and purpose of controlling, Types of control. Personnel management. Functions of personnel management. Manpower planning. Process of manpower planning. Recruitment. Selection: Promotion - Seniority Vs Merit.

UNIT 2. **Human Resource Management:** Nature and Scope of Human Resource Planning, Functions of HRM, Career Growth, Grievances, Reward and Punishment. Leaders: Kind of Leaders, leadership styles, Roles and Function of

Leaders, Conflict Management, Kinds and Cause of Conflict, Settlement of Conflict, Group and Team working, Organizational Design and Development.

UNIT 3. **CRM & CB:** Introduction to CRM, Difference between Customer Relation Management and Customer Retention Management. Consumer Markets and Customer Behaviour. Objectives, Importance, Limitations and Process of Marketing Research.

UNIT 4. **General Accounting:** Meaning, Concepts and Conventions of Accounting, Book Keeping, Financial Statement Analysis, Financial Ratios, Concept of Capital Budgeting.

UNIT 5. **Strategic and Technology Management:** Need, Nature, Scope and Strategy, SWOT analysis, Management Information System, Role of information in decision making, Information system planning, Design and implementation, Evaluation and Effectiveness of Information System.

Course Outcomes:

- To study about management functions.
- To Study about Organization system.
- To study about different Management techniques, planning, organising, staffing, directing and controlling of human resource.
- Design and implementation, Evaluation and Effectiveness of Information System.

Reference Books

1. Principles and Practice of Management - R.S. Gupta. B.D.Sharma, N.S. Bhalla. (Kalyani)
2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)
3. Principles & Practices of Management - L.M. Prasad (Sultan Chand & Sons)
4. Management - Harold, Koontz and Cyrilo Donell (McGraw Hill).
5. Marketing Management - S.A. Sherlikar (Himalaya Publishing House, Bombay).
6. Financial Management - I.M. Pandey (Vikas Publishing House New Delhi)
7. Management - James A.F. Stoner & R.Edward Freeman. PHI.
8. CRM Handbook – Jill Dyche (Pearson Education)
9. Management Information Systems: Managing the Digital Firm - K.C. Laudon. and J.P. Laudon. (10th Edition) Prentice Hall, 2007.

MU408A (7) MARKETING MANAGEMENT

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To understand the concept of marketing. To study marketing management in production system. To study new product development with case studies ,marketing strategies and planning.

Syllabus:

UNIT 1. Definitions of Marketing, Role of MM in industries, Introduction to Marketing function: the marketing concept. Marketing Management System: objectives, its interfaces with other functions in the organisation. Environment of Marketing- Economic Environment, Market: market segmentation. Consumer-buyer behaviour models. Socio- cultural environment. Legal Environment, Role of MM in Production System

UNIT 2. Marketing Strategy: Marketing planning and Marketing programming. The concept of marketing mix, Product policy; the concept of product life cycle. New product decisions. Test marketing- Pricing Management of distribution: channels of distribution. Advertising and production. The concept of Unique Selling Proposition, Role of strategy in production system.

UNIT 3. Implementation and Control: The marketing organization- alternative organization structures; the concept of product management. Administration of the marketing programme, sales forecasting; marketing and sales budgeting; sales management; management of sales force. Evaluation of marketing performance; sales analysis; control of marketing effort; marketing audit ,controlling of production system.

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

- Understand the role of Marketing Management in industries
- Understand role of Marketing strategies and planning.
- Develop new product .
- Understand the role of forecasting.
- Understand control of Budgeting

Text Books

1. Enis, B.M. Marketing Classics: A Selection of Influential Articles, New York, McGraw Hill, 1991.
2. Kotler, Philip and Armstrong,G. Principles of Marketing. New Delhi, Prentice Hall of India, 1997.
3. Kotler, Philip. Marketing Management: Analysis, Planning, Implementation and Control, New Delhi, Prentice Hall of India, 1994.
4. Ramaswamy, VSand Namakumari, S. Marketing Management: Planning, Control, New Delhi, MacMilian, 1990.
5. Stanton, William, J. Fundamentals of Marketing. New York, McGraw Hill, 1994.
6. Neelamegham, S. Marketing in India: Cases and Readings. New Delhi, Vikas 1988.

MU410A (1) :ECONOMICS AND INFORMATION SECURITY

B.Tech VIII Semester

No. of Credits: 3	Sessional:	40 Marks
L T P Total	Theory :	60 Marks
3 0 0 3	Total:	100 Marks
	Duration of Exam.:	3Hours

Course Objectives:

To study concept of production and factors of production and various types of cost. To study various aspects of information security : trade-secrets, ethical hacking, window hacking, E-mail hacking and password-cracking.

Syllabus:

UNIT 1. **Introduction to the subject:** Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.

UNIT 2. **Demand and supply**: Meaning of Demand, Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation); Supply and law of supply, Role of demand and supply in price determination.

UNIT 3. **Production and Cost Analysis:** Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.

Unit 4. **Information Security concept:** Information security overview, security services (Confidentiality, Integrity, Non-repudiation, Authentication, Access Control), Goals of Security, Ethical Issues in computer Security, Security Requirements**.**

Unit-5 **Intruders :**Hackers, Crackers, Virus, Worm, Trojan horse, Logic bomb, Time bomb, Trapdoor, Control against program threats.

Unit-6 **Ethical Issues and hacking Issues :** Copyright, Patent, Trade-secrets Ethical hacking, Window hacking, Google Hacking, E-mail hacking, password-cracking

Unit 7 **Methods to Curb Security:** Cryptography, Cryptanalysis, Substitution, Transposition, DES, Hash functions: MD5, public- Private Key concept: RSA, Digital Signatures, Digital Certificates: X.509, Firewalls, E-mail Security: PGP, S/MIME.

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

- Understand the concepts and factors for production cost.
- Understand demand and supply concept in economics.
- Understand the concept of cost and cost reduction.
- Understand the role of hacking.
- Understand control against cyber threats.

Reference Books

1. William Stalling, Cryptography and Network Security, 3rd Edition. PHI New Delhi
2. William Stalling, Network Security Essentials, 2nd Edition. PHI New Delhi
3. Security in Computing 4th Edition by Charles P. Pfleeger, PHI.
4. Chopra P. N., Principle of Economics, Kalyani Publishers
5. Dewett K. K., Modern economic theory, S. Chand
6. H. L. Ahuja., Modern economic theory, S. Chand
7. Dutt Rudar & Sundhram K. P. M., Indian Economy
8. Mishra S. K., Modern Micro Economics, Pragati Publications
9. Pandey I.M., Financial Management; Vikas Publishing House

MU410A (2): Metrology and Measurement

B. Tech. (Mech. Engg.) VIII Semester

No. of Credits: 4	Sessional: 40 Marks
L T P Total	Theory: 60 Marks
3 0 0 3	Total : 100 Marks
	Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts of measurement and measuring instruments. To study different types of measurement system used in mechanical engineering , different types of signal conditioning system and circuit used in the measurement system

Syllabus:

UNIT 1. **Introduction:** Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors.

UNIT 2. **Sensors and Transducers**: Types of sensors, types of transducers and their characteristics. Measurement of pressure: Gravitational, direct acting, elastic and indirect type pressure transducers. Measurement of very low pressures: McLeod gauge, Knudsen gauge, Pirani gauge, ionization gauges.

UNIT 3 **Signal conditioning:** signal conditioning ,ac and dc signal condition system, amplitude modulation and demodulation, types of filters: active and passive filters: input circuits :simple current sensitive circuits, Ballast circuits, wheatstone bridge circuits. Measurement of angular velocity: tachometers,

digital and stroboscopic methods.

UNIT 4. **Strain Measurement**: Types of strain gauges and their working. Temperature compensation. Strain rosettes, Measurements of force: scales and balances, Hydraulic and Pneumatic load cell,load cell, proving ring. Measurement of torque:strain gauge torque meter,inductance torque transducers stroboscopic methods. Temperature measurement by thermometers, bimetallic, thermocouples, thermistors and pyrometers.

UNIT 5. **Measurement of Flow:** Obstruction meters, variable head meters, hot wire and magnetic meters, ultrasonic flow meters etc. Vibration and noise measurement: Seismic instruments, vibration pick ups and decibel meters.

UNIT 6. **Metrology**:Dimensional measurements, Measurement of geometric forms like straightness, flatness, roundness and circularity, Optical projectors, Interferometry: principle and uses of interferometry, optical flat and interferometers, laser 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.

UNIT 7. **Non-Destructive Testing :** Magnetic Dust Method, Penetrating Liquid Test, Ultrasonic Test, Radiography: X ray and Gamma-ray.

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

- Understand the concept of measurement and errors involved in the measurement
- Understand different types of sensors used in measuring system, measurement of pressure
- Understand different types of signal conditioning system and circuit used in the measurement system
- Understand the measure of flow, temperature, strain, force, vibration and noise
- Understand software and hardware tools to build mechatronics system

Text Books

1. Beckwith ThomasG., "Mechanical Measurements", Narosa Publishing House ,N. Delhi
2. Doeblein, E. O., "Measurement Systems, Application Design" ,McGraw Hill,
3. 1990
4. Kumar, D. S., "Mechanical Measurements and Control", Metropolitan, N. Delhi.
5. Humc, K.,"Engineering Metrology", MacDonald and Co. 1963.
6. Sawhney A.K,Swhney Puneet "Mechanical measurements and instrumentation control & control" Dhanpat Rai &Co.
7. Bewoor andKulkarni "metrology and measurements" McGrawhill

MU 410A(3): PLASTICS MOULD MANUFACTURING

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

Sessional: 40 Marks
Theory : 60 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts of plastic mould manufacturing. To study different types of surface treatment of mould materials. To study various mould making techniques and procedure for estimating mould cost estimation .

UNIT I : MATERIAL FOR MOULDS

Selection of steels – Properties of steels – common steels used for moulds – strength of materials, calculation of wall thickness for cavity – Insert size – Life of mould Non-ferrous metals for mould construction: Application – Zinc base alloys – Aluminium alloys – Beryllium copper

Non-metallic materials for mould construction: Advantages and its applications – epoxies - polyester – silicon

UNIT II : SURFACE TREATMENT OF MOULD MATERIALS

Introduction – Heat treatment process – case hardening – through hardening – nit riding – tips on successful heat treatment – vacuum hardening – cryogenic heat treatment – Hard chrome plating – Nickel plating – chemical etching – Mould Polishing techniques

UNIT III: MOULD MAKING TECHNIQUES

Pantograph engraving – Hydro copying – Jig boring – CNC machines – CNC Lathe – CNC Milling – CNC EDM – Advantages and its Applications – Assembly of moulds – Rapid prototyping

UNIT IV: MOULD ESTIMATION, REPAIR AND PROTECTION

Procedure for estimating mould cost – General outline – Cost calculation – Basic moulds – Cavity – Basic functional components – Special functions etc. Introduction – Mould Repair and maintenance – scheduling mould maintenance – advantages – storage – corrosion protection – wear and lubrication – special consideration.

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

- Understand about the types of non-metallic materials for mould construction.
- Complete understanding about various types of heat treatment processes and plating.
- Understanding the various mould making techniques.
- Understand mould repair and maintenance.
- Understand wear and lubrication of the mould.

REFERENCES

1) Cyril Donaldson George H. Lecain V C Goold, Tool Design, TATA McGraw-Hill, 1998.
2) Richard R. Kibbe John E. Neele, Roland O Meyer, Warran T. White, Machine Tool Practices, Prentice Hall of India Pvt. Ltd., 1999.
3) Irwin Rubin, Injection Moulded Theory and Practice, Wisely Interscience Publication, 1972.
4) Society of Plastics Industry, Plastics Engineering Hand Book, Van Nostrand Reinhold Company, 1960.
5) Dominick V. Rosato, Donald V. Rosato, Injection Moulding Hand Book, CBC Publishers & Distributors, 1987.

MU410A(4): ROBOTIC ENGINEERING
B.Tech. 8th sem

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

Sessional: 40 Marks
Theory : 60 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Course Objectives:
To study essential concepts of structure of robots and robot. To study different types controllers and kinematics of robot controllers. To study robot motion trajectory, robot intelligence and task planning.

Introduction:
Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Specifications of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, Types of Drive Systems and their Relative Merits, the Wrist & Gripper Subassemblies.

Control of Robots:
Concepts and Model about Basic Control System, Transformation and Block Diagram of Spring Mass System, Control Loops of Robotic Systems, PTP and CP Trajectory Planning, Different Types of Controllers, Control Approaches of Robots.

Kinematics of Robot Manipulator:
Introduction, General Description of Robot Manipulator, Mathematical Preliminaries on Vectors & Matrices, Homogenous Representation of Objects, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll-Pitch-Yaw(RPY) Transformation, Relative Transformation, Direct & Inverse Kinematics' Solution, D H Representation & Displacement Matrices for Standard Configurations, Geometrical Approach to Inverse Kinematics. Homogeneous Robotic Differential Transformation: Introduction, Jacobian Transformation in Robotic Manipulation.

Robotic Workspace & Motion Trajectory:
Introduction, General Structures of Robotic Workspaces, Manipulations with n Revolute Joints, Robotic Workspace Performance Index, Extreme Reaches of Robotic Hands, Robotic Task Description.

Robotic Motion Trajectory Design: –
Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories:- 4-3-4 & 3-5-3 Trajectories, Admissible Motion Trajectories.

Industrial Applications:
Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming, Goals of AI Research, AI Techniques, Robot Intelligence and Task Planning, Modern Robots, Future Application, Challenges and Case Studies.

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

- Understand about the types of robots and their structure.
- Complete understanding about notion trajectory of a robot.
- Understanding the kinematics of a robot manipulator.
- Understand various types of trajectory interpolators.
- Understand various types of controllers in controlling the motion of a robot.

Text Books/ Reference Books:

1. A Robot Engineering Textbook – Mohsen Shahinpoor – Harper & Row publishers, New York.
2. Robotics, control vision and intelligence, Fu, Lee and Gonzalez. McGraw Hill International.
3. Introduction to Robotics, John J. Craig, Addison Wesley Publishing.
4. Robotics for Engineers , Yoram Koren, McGraw Hill International.
5. Industrial Robotics, Groover, Weiss, Nagel, McGraw Hill International.
6. Company Fundamentals of Robotics Analysis and Control, Schilling, PHI.
7. Introduction to Robotics, Niku, Pearson Education, Asia.
8. Robotics, control vision and intelligence, Fu, Lee and Gonzalez. McGraw Hill International.

MU- 410 A(5): Industrial Controls

B.Tech VIII Semester

No. of Credits: 3		Sessional:	40 Marks
L T P	Total	Theory:	60 Marks
3 0 0	3	Total :	100 Marks
		Duration of Exam:	3 Hours

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.

UNIT 1. **Introduction :** Meaning and need of automation, Types of automation: fixed, programmable, flexible, and integrated automation.

UNIT 2. **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 3. **Logic control and PLCs:** Logic control, logic control elements, Programmable logic controllers: Applications, architecture, operation, and programming of PLCs. Typical applications.

UNIT 4. **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 5. **Automated inspection systems:** In process gauging systems, Co-ordinate measuring machines: Construction, operational modes and different probes.

UNIT 6. **Factory communication:** interface standards, communication networks, LAN, WAN, Protocols: OSI and MAP.

UNIT 7. **Flexible Manufacturing systems:** Types, components, architecture and control. Computer integrated manufacturing.

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

- Understand about programmable logic controllers.
- Complete understanding about communication networks for automation..
- Understanding the role of human factors in a project.
- Understand various types of sensors and actuators for various applications.
- Understand flexible manufacturing system for making variety of components.

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.

MU 410 A (6) : SOLID WASTE
B.Tech VIII Semester

No. of Credits: 3	Sessional:	40 Marks
L T P Total	Theory:	60 Marks
3 0 0 3	Total :	100 Marks
	Duration of Exam:	3 Hours

Course Objectives:

To study Sources and types of solid wastes . To study resource recovery from solid wastes, on-site segregation of solid wastes, public health & economic aspects of storage and dumping of solid waste under Indian conditions.

Syllabus:

UNIT I : SOURCES AND TYPES OF MUNICIPAL SOLID WASTES

Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

UNIT II : ON-SITE STORAGE & PROCESSING

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options

UNIT III : COLLECTION AND TRANSFER

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

UNIT IV : OFF-SITE PROCESSING

Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

UNIT V : DISPOSAL

Dumping of solid waste; sanitary land fills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

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

- Understand about the types of solid waste and disposal.
- Design and operation of sanitary landfills.
- Understanding various methods of collection and types of vehicles for solid waste.
- Understand social & economic aspects.

Text Books/Reference Books:

1. George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 1993.
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, "Waste Management", Springer, 1994
3. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000
4. R.E.Landreth and P.A.Rebers, "Municipal Solid Wastes – problems and Solutions", Lewis Publishers, 1997.
5. Bhide A.D. and Sundaresan, B.B., "Solid Waste Management in Developing Countries", INSDOC, 1993

The Syllabus for Open Elective Subjects

Intelligent Systems (OEC-1)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1: Fundamental Issues In IS : Defi 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 2:Heuristic Search Techniques :Generate & Test ,HillClimbing(simple & stipest),Best first search ,A*, AO*, Constraint satisfaction.

UNIT 3:Knowledge Representation Issues :Systax & 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 4:Reasoning Under Uncertainity :An introduction ,Default reasoning & Closed world assumptions ,Model & Temporal logic ,Fuzzy logic ,Basian Probabilstic inference Dempster Shafer theory ,Heuristic reasoning methods

UNIT 5: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 6: 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.

Cyber Laws and Security (OEC-2)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 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

Soft Computing (OEC-3)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 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 0-1Knapsack 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.

Web Technology & Information Retrieval(OEC-4)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1. 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 2 .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, PageRank,

UNIT 3. Web Crawlers: Basics of Web crawling, Various crawling techniques , incremental crawler, parallel crawler, distributed crawlers, focused crawler, agent based crawler, Hidden web Crawler

UNIT 4. 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 5. 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.

Intellectual Property Rights(OEC-5)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours
UNIT 1: 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 Books: 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.

Installation Testing & Maintenance of Electrical Equipments(OEC-6)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT-1.Installation Of Electrical Equipements: Introduction Unloading of electrical equipment at site Inspection Storage Foundation Alignment of electrical machinesTools/Instruments necessary for installation Inspection, storage and handling of transformer, switchgear and induction motor Preparation of technical report

UNIT-2.Commissioning And Testing:Tests before commissioning of electrical equipment :Electrical and Mechanical test Specific tests on - transformer, induction motor, alternator, synchronous power and electrical power installation Need of gradually loading of Various Tests to be performed after commissioning and before starting the machine Various instruments required for testing Commissioning of switchgear Test report on commissioning and test certificate electrical equipment Preparations before commissioning of power transformer Commissioning- power transformer, three phase induction motor Transformer insulation oil: Properties as per IS, sampling, testing and filtering/purifying, standard tests as per IS Measurement of insulation resistance of different equipments/machines Methods of Drying the winding of electrical equipments and its record Classification and measurement of insulation resistance, Polarization Index Appropriate insulation test for specific purpose Factor affecting

UNIT-3.Maintenance Of Electrical Equipments: General aspect of maintenance, Classification Preventive maintenance-concept, classification, advantages, activities, functions of the Maintenance Department Breakdown maintenance-concept, advantages, activities Reasons of failure of electrical equipment due to poor maintenance Factors for preparing maintenance schedule Frequency of maintenance Maintenance schedule of transformer below and above 1000kVA Maintenance schedule - induction motor, circuit Breaker, overhead line, storage Battery Probable faults due to poor maintenance in transformer, induction motor, circuit breaker, overhead lines and battery

UNIT-4.Trouble Shooting:Causes of fault in electrical equipments- Internal and external Instruments and tools for trouble shooting Common troubles in electrical equipment – DC Machines, AC Machines, Transformers, Circuit- breaker, under-ground cable, electrical Installation Need of trouble shooting chart, advantages Trouble shooting chart – DC Motor, DC Generator, Transformer, Synchronous Motor, Induction Motor, Circuit-breaker Trouble shooting chart for Domestic appliances- electrical iron, ceiling fan, Washing machine, Air cooler, Vacuum cleaner Fluorescent tube light: Construction, working and troubleshooting chart

UNIT-5.Earthing:Necessity of earthing System earthing : advantage of neutral earthing of generator in power station Equipment earthing: Objective Types of earth electrodesMethods of earthing : plate earthing,pipe earthing and coil earthing Earthing in extra high voltage and underground cable Earthing resistance- factor affecting Determination of maximum permissible resistance of the earthing system Measurement of earth resistance: voltmeter-ammeter method, earth tester method, ohm meter method and earth loop tester method

Define: earthing , grounding and bonding Comparison between equipment earthing and system grounding Earthing procedure - Building installation, Domestic appliances, Industrial premises Earthing in substation, generating station and overhead line

UNIT-6.Electrical Accidents And Safety: Causes of electrical accidents Factors affecting the severity of electrical shock Actions to be taken when a person gets attached to live part Safety regulations and safety measures Indian electricity supply act 1948- 1956 Factory act 1948 Procedure of shut down for sub- station and power lines Permit to work : certificate of (i)requisition for shut down(ii) Permit to work and (iii)Line clear certificate Instruction for the safety of persons working on a job with a permit to work Fire extinguishers- For fixed installation and portable devices

REFERENCE/TEXT BOOKS:

1. Testing Commissioning operation and maintenance of Electrical Equipments by Rao S, Khanna Publication (Latest edition)

2. Installation, commissioning & maintenance of Electrical equipments by Singh TARLOK, S.K.Kataria & Sons, New Delhi, Second edition-2012

3. Electrical power system by Wadhwa C.L., New Age international Publications

Non-Conventional Energy Resources And Utilisation(OEC-7)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours
UNIT 1. 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. 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 2 :Solar energy: Solar thermal power and it's 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 energystorage, Different systems, solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, Solar Cooking, Green Houses, 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 3 : 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. 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 4 : Electrochemical effects and fuel cells: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells, 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 5.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, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

REFERENCE/TEXT BOOKS:

1. Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata McGrawHill.
2. Kothari D.P., "Renewable energy resources and emerging technologies", Prentice Hall of IndiaPvt.Ltd.
3. Ashok V. Desai, "Non conventional Energy", New Age International Publishers Ltd.

Utilization Of Electric Power And Traction(OEC-8)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours
UNIT-I :Illumination : Basic laws of illumination, illumination due to a strip and circular disc, light sources and their characteristics, sources of light, design of lighting schemes, incandescent lamp, sodium lamp, mercury lamp and fluorescent lamp, comparison of various lamps. UNIT-II. Electric Heating: Principle and application of resistance, induction , dielectric heating and temperature control UNIT-III. Electric Welding: Resistance welding, arc welding, welding generator and welding transformer, properties of arcing electrode UNIT-IV.Electrolyting Process: Principles and applications of electrolysis, Faraday's law of electrolysis, electroplating, charging and discharging, capacity and efficiency of battery, defects in battery. UNIT-V.Electric Traction :Advantages of electric traction, requirements of an ideal traction system, train movement, mechanism of train movement, traction motors, traction motor control, multi unit control, braking of electric motors, thyristor control of electric traction	
REFERENCE BOOKS:	

1. Utilization of electric energy: Open Shaw Taylor; ELBS
2. Art and Science of Utilization of Electrical energy: H.Pratab; Dhanpat Rai
3. Generation, distribution and utilization of electric power: C.L. Wadhwa; Khanna Publications

Industrial Engineering(OEC-9)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 8. Basic Concepts of Industrial Engineering: 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 9. Productivity, Workforce & Information Management: Productivity Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity, Various methods of Job evaluation & merit rating, Various incentive payment schemes, Organizational & information system structure,

UNIT 10. 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 11. 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 12. Sales Forecasting: Importance, Objectives, Forecasting and Prediction, Types, Classification of Forecasting Methods, Forecast Errors, Costs and Accuracy of Forecasts, Numerical Problems.

UNIT 13. Entrepreneurship : Planning a New Business Venture, Small-scale Industries,

Government Policies for Small-scale Industries, Project Identification and Project Formulation, Project Appraisal, Laws Concerning Entrepreneurs, Role of Various National and State Agencies that Render Assistance to Small-scale Industries.
Text Books 1. Production & Operations Management – Chary, TMH, New Delhi. 2. Management Information Systems - Sadagopan, PHI New Delhi. Reference Books 1. Modern Production Management – S.S. Buffa, Pub.- John Wiley. 2. Operations Management - Schroeder, McGraw Hill ISE. 4. Operation Management - Monks, McGraw Hill ISE. 5. 4. Production & Operations Management - Martinich, John Wiely SE. 6. Industrial & Systems Engineering - Turner, MIZE, CHASE, Prentice Hall Pub. 7. 7. Industrial Engineering & Operations Management – SK Sharma, Pub-S. K. Kataria 8. 7. Industrial Engineering – Ravi Shankar, Galgotia Pub.

Total Quality Management (OEC-10)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100

	Duration of Exams: 3 Hours

UNIT 1: Introduction : Quality – Basic concepts, dimensions, economics of quality, quality Gurus.TQM: Definition, evolution, journey from inspection to TQM, comparison at different stages, dimensions of TQM, TQM viewpoints, reasons for adopting TQM.

UNIT 2: Introspection to TQM environment: Sphere of TQM, components of TQM, TQM Managing Total Quality, Factors affecting TQM environment, Classification and interaction among factors, Researchers' viewpoint, TQM as a system, steps in TQM implementation, Roadblocks in TQM implementation, Reasons for TQM failure.

UNIT 3:Role of soft options in TQM :Hard vs. Soft factors, Role and expectation of employer, employee, customer and supplier from organization and vice versa. Human factors in TQM, Role of top management commitment, work culture, motivation, coordination, attitude, innovation.

UNIT 4:Quality initiatives in organizations :Role of tools and techniques in TQM, Classification of tools and techniques – Problem identification, Data analysis, Graphical, Creativity, Company wide. Brief description of Quality awards – MBNQA, Deming award, European quality award, Australian quality award.

UNIT 5: TQM Effectiveness : Impact of TQM, Need and difficulty in measuring TQM effect, Parameters governing effect of TQM .

Reference books:

1) "Total Quality Management" by Oakland (Butterworth – Heinamann Ltd.)
2) "Managing for total quality from Deming to Taguchi and SPC" by Logothetis N. (PHI)
3) "Total Quality Control" by Feigenbaum A.V. (MGH)
4) "Total Quality Management" by Besterfield Dale H (Pearson Education)
5) "A slice by slice guide to TQM" by John Gilbert (Affiliated East West Press)
6) "The TQM toolkit – a guide to practical techniques for TQM" by Waller Jenny, Allen Derek and Burna Andrew (Kogan Page)

Solid Waste(OEC-11)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT I : Sources And Types Of Municipal Solid Wastes :Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

UNIT II : On-Site Storage & Processing :On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options

UNIT III : Collection And Transfer :Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

UNIT IV : Off-Site Processing :Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

UNIT V : DISPOSAL :Dumping of solid waste; sanitary land fills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

Text Books/Reference Books:

1. George Tchobanoglous et.al., “Integrated Solid Waste Management”, McGraw-Hill Publishers, 1993.
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, “Waste Management”, Springer, 1994
3. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000
4. R.E.Landreth and P.A.Rebers, “Municipal Solid Wastes – problems and Solutions”, Lewis Publishers, 1997.
5. Bhide A.D. and Sundaresan, B.B., “Solid Waste Management in Developing Countries”, INSDOC, 1993

Product Design and Development(OEC-12)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1. Introduction: Design theory, design materials, human factors in design, man-machine system, applied ergonomics, characteristics of successful product development, challenges to product development.

UNIT 2.Development process and product planning: Generic development process, Concept development, product development process flows, product planning process, identify customer needs.

UNIT 3. Product specifications and concept generation: Product specification, steps to establish the target specifications, Concept generation, five step concept generation method, concept selection, concept screening, concept testing, product architecture

UNIT 4. Product design methods: Creative and rational, clarifying objectives - the objective tree method, establishing functions- the function analysis method, setting requirements – the performance specification method, determining characteristics – the QFD method, generating alternatives – morphological chart method, evaluating alternatives – the weighted objective method, improving details – the value engineering method and design strategies.

UNIT 5. Design for manufacture: Estimating manufacturing cost, reducing component, assembly and support costs, design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective prototyping – principle and planning

UNIT 6. Industrial design: Its need, impact and quality, industrial design process and its management, legal issues in product design, design resources, economics and management of product development projects.

UNIT 7. Prototyping: Basics and principles of prototyping, prototyping technologies, planning for prototypes

Text Books

5. K.T. Ulrich and S.D. Eppinger, "Product design and development", Tata McGraw Hill
6. Chitale & Gupta, "Product Development", Tata McGraw Hill
7. Monks, J. G., "Operations Management", McGraw Hill, 1997.
8. George Dietor, A material and Processing approach, McGraw Hill

Power Plant Engineering (OEC-13)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1. Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

UNIT 2. 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 3. 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 4. 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 5. 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 6. 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-out put curves, efficiency, heat rate, economic load sharing, Problems.

UNIT 7. 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 8. 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.

Robotics Engineering(OEC-14)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1 . Introduction: Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Specifications of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, Types of Drive Systems and their Relative Merits, the Wrist & Gripper Subassemblies.

UNIT 2. Control of Robots:Concepts and Model about Basic Control System, Transformation and Block Diagram of Spring Mass System, Control Loops of Robotic Systems, PTP and CP Trajectory Planning, Different Types of Controllers, Control Approaches of Robots.

UNIT3. . Kinematics of Robot Manipulator: Introduction, General Description of Robot Manipulator, Mathematical Preliminaries on Vectors & Matrices, Homogenous Representation of Objects, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll-Pitch-Yaw(RPY) Transformation, Relative Transformation, Direct & Inverse Kinematics' Solution, D H Representation & Displacement Matrices for Standard Configurations, Geometrical Approach to Inverse Kinematics. Homogeneous Robotic Differential Transformation: Introduction, Jacobian Transformation in Robotic Manipulation.

UNIT4 . Robotic Workspace & Motion Trajectory: Introduction, General Structures of Robotic Workspaces, Manipulations with n Revolute Joints, Robotic Workspace Performance Index, Extreme Reaches of Robotic Hands, Robotic Task Description.

UNIT5 . Robotic Motion Trajectory Design: Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories:- 4-3-4 & 3-5-3 Trajectories, Admissible Motion Trajectories.

UNIT6 .Industrial Applications: Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming, Goals of AI Research, AI Techniques, Robot Intelligence and Task Planning, Modern Robots, Future Application, Challenges and Case Studies.

Text Books/ Reference Books:

9. A Robot Engineering Textbook – Mohsen Shahinpoor – Harper & Row publishers, New York.
10. Robotics, control vision and intelligence, Fu, Lee and Gonzalez. McGraw Hill International.
11. Introduction to Robotics, John J. Craig, Addison Wesley Publishing.

12. Robotics for Engineers , Yoram Koren, McGraw Hill International.
13. Industrial Robotics, Groover, Weiss, Nagel, McGraw Hill International.
14. Company Fundamentals of Robotics Analysis and Control, Schilling, PHI.
15. Introduction to Robotics, Niku, Pearson Education, Asia.
16. Robotics, control vision and intelligence, Fu, Lee and Gonzalez. McGraw Hill International.

Microprocessor and Interfacing(OEC-15)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT1. Architecture of 8085: Functional block diagram—Registers, ALU, Bus systems. Pin configuration, Timing and control signals, Machine cycle and timing diagrams. Interrupts—Types of interrupt, interrupt structure.

UNIT2. Programming of 8085: Instruction format, Addressing modes, Instruction set. Development of assembly language programs.

UNIT3. Interfacing Devices:(a).The 8255 PPI chip: Architecture, pin configuration, control words, modes and Interfacing with 8085. (b). The 8254 PIC chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.

UNIT4. Interrupt and DMA controller: The 8259 Interrupt controller chip: Architecture, pin configuration, control words, modes

UNIT5. Architecture of 8086: Functional block diagram of 8086, details of sub-blocks such as EU, BIU,memory segmentation, physical address computations, pin configuration, program relocation, Minimum and Maximum modes of 8086— Block diagrams and machine cycles.

UNIT6. Programming of 8086: Instruction format, Addressing modes, Instruction set and programs.

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.
2. Microprocessor and applications – A.K.Ray. , TMH

REFERENCE BOOKS:

1. Microprocessors and interfacing : Hall; TMH

2. The 8088 & 8086 Microprocessors-Programming, interfacing,Hardware& Applications :Triebel& Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming &Design : Yu-Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing :Badri Ram; TMH

Digital Signal Processing(OEC-16)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT1. DISCRETE-TIME SIGNALS: Signal classifications, frequency domain representation, time domain representation, representation of sequences by Fourier transform, properties of Fourier transform, discrete time random signals, energy and power theorems.

UNIT2. DISCRETE-TIME SYSTEMS: Classification, properties, time invariant system, finite impulse Response (FIR) system, infinite impulse response (IIR) system.

UNIT3. SAMPLING OF TIME SIGNALS:Sampling theorem, application, frequency domain representation of sampling, reconstruction of band limited signal from its samples. Discrete time processing of continuous time signals, changing the sampling rate using discrete time processing.

UNIT4. Z-TRANSFORM: Introduction, properties of the region of convergence, properties of the Z-transform, inversion of the Z-transform, applications of Z-transform.

UNIT5. BASICS OF DIGITAL FILTERS: Fundamentals of digital filtering, various types of digital filters, design techniques of digital filters : window technique for FIR, bi-linear transformation and backward difference methods for IIR filter design, analysis of finite word length effects in DSP,FIR &IIR Filter structure-direct1,direct2,cascadeand parallel, Application of DSP

TEXT BOOKS :
1. Digital Signal Processing :Proakis and Manolakis; PHI
2. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH

REFERENCE BOOKS:
1. Digital Signal Processing: Alon V. Oppenhelm;PHI

2. Digital Signal processing(II-Edition): Mitra, TMH

Instrumentation and Control(OEC-17)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1. OSCILLOSCOPE: Block diagram, study of various stages in brief, high frequency CRO considerations. Sampling and storage oscilloscope.

UNIT 2. ELECTRONIC INSTRUMENTS: Instruments for measurement of voltage, current & other circuit parameters, introduction to digital meters.

UNIT 3. GENERATION & ANALYSIS OF WAVEFORMS: Block diagram of pulse generators, signal generators, function generators wave analysers, distortion analysers, spectrum analyser, Harmonic analyser, introduction to power analyser.

UNIT 4. FREQUENCY & TIME MEASUREMENT: Study of decade counting Assembly(DCA), frequency measurements, period measurements, universal counter, introduction to digital meters.

UNIT 5. TRANSDUCERS: Classification, Transducers of types: RLC photocell, thermocouples etc. basic schemes of measurement of displacement, velocity, acceleration, strain, pressure, liquid level & temperature.

UNIT 6.CONTROL SYSTEM : Concept of transfer function, relationship between transfer function and impulse response, order of a system, block diagram algebra, signal flow graphs : Mason's gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements.

TEXT BOOK:

1. A course in Electrical & Electronics Measurements &Instrumentation :A.K.Sawhney; DhanpatRai& Sons.
2. Control System Engineering : I.J.Nagrath&M.Gopal; New Age
3. Modern Control Engg : K.Ogata; PHI.

REFERENCE BOOKS.

1. Electronics Instrumentation & Measurement Techniques : Cooper; PHI.

Data Communication and Networking(OEC-18)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT1. Introduction : Data Communication, Networks, Internet, Intranet, Protocols, OSI & TCP/IP Models Addressing. Physical Layer – Signals, Analog, Digital, Analog VS Digital, Transmission impairment, Data Rate Limits, Performance. Digital Transmission – Line Coding (Umipolar, Polar, Biphase), Block Coding (4B/5B Encoding), Analog to digital conversion, PCM, Transmission Modes. Analog Transmission – Digital to analog conversion (ASK, FSK, PSK, QAM), Analog to Analog conversion. Multiplexing – FDM, WDM, Synchronous TDM (time slots & frames, interleaving, data rate management). Spread Spectrum – FHSS, DSSS Transmission Media – Guided and Unguided. Switching – Switching, Circuit-Switched Networks, Datagram networks, Concept of Virtual circuit networks, structure of circuit and packet switch. Concepts of DSL and ADSL.

UNIT 2. Data Link Layer : Error correction & detection. Types of errors. Detection VS Correction, Block Coding, Hamming Distance, Linear Block codes (single parity check, hamming codes), Cyclic codes, CRC Encoder & Decoder, DRC Polynomial and its degree, Checksum.

UNIT 3.Network layer protocol : Internetworking,IPv4, IPv4 protocol packet format, IPv6 Protocol & Packet format, IPv4 VS IPv6, Transition from IPv4 to IPv6,Address Resolution protocols (ARP, RARP), BOOTP, DHCP, Routing Protocols – Delivery, forwarding, routing, types of routing, routing tables, Unicast Routing, Unicast Routing protocols, RIP, Concepts of OSPF, BGP & Multicast Routing Transport Layer – Process to process delivery, UCP, TCP Congestion Control & Quality of Service – Data traffic, Congestion, Congestion Control (Open Loop, Closed Loop & Congestion control in TCP), QoS and Flow Characteristics Application Layer – DNS, Remote Logging (Telnet), SMTP, FTP, WWW, HTTP

Soft Skills for Engineers (OEC-19)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

Unit-I- CORPORATE INTERACTION, LEADERSHIP & COMMUNICATION

Part I.Audio/Video Lessons and Observation/Listening Skills (Practical)Interviews Lectures by Eminent Engineers, scientists and technocrats. Other inspiring speeches on social issues as well as related to the corporate world and industry.

Part-II.Group Discussions, Corporate Dialogue/Role Play (conflict and resolution);Mock-interviews.Discussions with briefs on CSR and IPR and role of important international bodies like WTO and IMF; Presentations; Technical/Business vocabulary; Body Language.

Part-III: Leadership & Participation:Review of social, political and corporate scene; Leadership skills, Attitudes, Sensitivity training.Learning/'Take-aways' from scenarios/situations. Crisis-handling; Negotiation-Conflict resolution exercises; Communication Skills; Seven Cs of Communication; Barriers of/to Effective Communication

Unit –II- CREATIVE COMPOSITION& TECHNICAL WRITING : Exercises in creative writing:USP and image building; Setting Goals; Charting Objectives; Minutes of a Meeting; Reports; Interoffice Memorandum; Resume and Covering Letter.

Unit –III- SEMANTICS & SYNTAX : Idioms & Proverbs, Vocabulary building, Crosswords, Neologisms, Portmanteau words, Correct sentences/usage.

Unit-IV- DISSERTATION & PRACTICAL ASSESSMENT :Short Multimedia Dissertation on any topic of student's interest; Group Discussion and Mock-interview

Resources

- Stephen Robbins and Seema Sanghi.Organizational Behaviour. Pearson. Latest edition.
- Kotler, Philip and Kevin Lane Keller.Marketing Management. 13 th edition.2008 Eastern Economy Edition
- Wehmeier, Sally.*Oxford Advanced Learner's Dictionary*. Oxford UP.2005
- Ghosh, BN. Managing Soft Skills for Personality Development.Tata McGraw-Hill 2012
- Rizvi, M Ashraf. *Effective Technical Communication*. Tata Mc Graw-Hill.2005
- Bretag, Crossman and Bordia.Communication Skills. Tata Mc Graw-Hill.2009

- Sites: Youtube and Wikipedia in general.

Maths-III(OEC-20)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT 1.Fourier Series and Fourier Transforms : Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, , half range sine and cosine series. Fourier expansion of square wave , rectangular wave, saw-toothed wave, half and full rectified wave, Fourier integrals. Fourier transforms, Shifting theorem (both on time and frequency axes), Fourier transforms of derivatives, Fourier transforms of integrals, Convolution theorem. application of fourier transform to solve standard equations/boundary value problems. Applications of fourier transform for solution of standard equations/boundary value problems.

UNIT2.Functions of Complex Variable : Definition, Exponential function, Trigonometric and Hyperbolic functions, Logarithmic functions, Limit and Continuity of a function, Differentiability and Analyticity. Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions,Milne Thomson Method to find harmonic conjugate of a function. application to flow problems. Integration of complex functions. Cauchy- Integral theorem and formula.Power series,radius and circle of convergence, Taylor's, Maclaurin's and Laurent's series.Zeroes and singularities of complex functions, Residues. Cauchy's residue theorem,Evaluation of real integrals using residues (around unit and semi circle only).

UNIT 3.Probability Distributions : Conditional probability, Bayes theorem and its applications, expected value of a random variable. Properties and application of Binomial, Poisson and Normal distributions.

Linear Programming: Linear programming problems formulation, solving linear programming problems using (i) Graphical method(corner point,iso cost/iso profit) (ii) Simplex method (iii) BIG M method (iv) Duality concept and Dual simplex method.

TEXT BOOKS :

1. Higher Engg. Mathematics : B.S. Grewal.
2. Advance Engg. Mathematics : R.K. Jain, S.R.K.Iyenger

REFERENCE BOOK

1. Advanced Engg. Mathematics : F Kreyszig.
2. Advanced Engg. Mathematics : Michael D. Greenberg.
3. Operation Research : H.A. Taha.
4. Probability and statistics for Engineers : Johnson. PHI

Human Resource Management(OEC-21)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT I : Human Resource Management: concept and scope; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals; Human Resource Planning & Forecasting: significance and process.

UNIT II :HR Sourcing: Recruitment, Selection and Induction. Job Analysis: job Description and job Specification; Job Design: concept and methods; Job Evaluation-concept &methods; Performance appraisal and counselling.

UNIT III :Training: training process and methods; Career planning and Development; Succession planning; Employee Compensation: basic concepts & determinants;

UNIT IV: Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM. HR Audit &Accounting, ethics & corporate social responsibility.

Suggested Readings:

1. K. Aswathapa Human resource Management: Text and cases, 6th edition, Tata McGraw Hill, New Delhi,2012
2. Uday Kumar Haldar &Juthika Sarkar(2012) Human resource Management New Delhi, Oxford University Press.
3. De Cenvo, Da & Robbins S.P.(2010) Fundamentals of Human Resource Management, 9th edition, New York, John Wiley & Sons.
4. Gary Dessler (2008) Human Resource Management, 11th edition New Delhi: Pearson Prentice Hall.
5. Tanuja Agarwala, Strategic Human resource Management, Oxford University Press 2007.

Financial Management(OEC-22)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT-I :Financial management-scope finance functions and its organisation, objectives of financial management; time value of money; sources of long term finance.

UNIT-II Investment decisions: importance, difficulties, determining cash flows, methods of capital budgeting; cost of different sources of raising capital; weighted average cost of capital.

UNIT-III:Capital structure: Meaning, importance, determinants and Theories. Financial and operating leverage; EBIT/EPS Analysis, determinants of dividend policy and dividend models -Walter, Gordon & M.M. models.

UNIT-IV:Working Capital- meaning, need, determinants; estimation of working capital need; management of cash, inventory and receivables.

Suggested Readings:

1. Pandey, I.M., Financial Management, Vikas Publishing House, New Delhi 10th edition 2010
2. Khan M.Y, and Jain P.K., Financial Management, Tata McGraw Hill, New Delhi
3. Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, FinancialManagement, Pearson Education
4. Chandra, Prasanna, Financial Management, TMH, New Delhi
5. Van Horne, James C., Financial Management and Policy, Prentice Hall of India
6. Brigham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.
7. Kishore, R., Financial Management, Taxman's Publishing House, New Delhi

Marketing Management(OEC-23)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT-I:Nature and scope of marketing; Philosophies of marketing management; marketing environment; marketing research and marketing information system; Ethical issues in marketing

UNIT-II: Understanding consumer behaviour; factors influencing consumer buying behaviour and organizational buying behaviour; market segmentation, targeting and positioning; marketing strategies in the different stage of the product life cycle; new product development process

UNIT-III: Introduction to Product mix and product line decisions; branding and packaging decisions; Pricing strategies and practices; factors affecting selection of marketing channels; Introduction to wholesaling and retailing; Introduction to Promotion Mix: Advertising, sales promotion, public relations, personal selling

UNIT-IV :Sales Forecasting Methods; Introduction: Green Marketing; Event Marketing; Direct marketing; Network Marketing; Holistic Marketing; Permission Marketing; Social Marketing

Suggested Readings:

1. Kotler and Armstrong,Principles of Marketing; PHI, New Delhi
2. Kotler, Philip, Kevin Keller, A. Koshy and M. Jha, Marketing Management in South Asian Perspective , Pearson Education, New Delhi
3 . Kerin, Hartley, Berkowtz and Rudelius, Marketing, TMH, New Delhi
4. Etzel, Michael J, Marketing: Concepts and Cases, TMH, New Delhi
5. Kumar,Arun and Meenakshi,N. ,Marketing Management, Vikas Publication

Entrepreneur Development(OEC-24)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT I : Concept of Entrepreneur, Characteristics, qualities and pre-requisites of entrepreneur, entrepreneurship and intrapreneur, Entrepreneur vs. Manager; Economic, social and psychological need for entrepreneurship;

UNIT II :Environmental Factors affecting success of a new business, Formulation of business plan, Contents and significance of business plan

UNIT III: Feasibility Study -Preparation of Feasibility Reports: Economic, Technical, Financial and Managerial Feasibility of Project, Methods and procedures to start and expand one's own business

UNIT IV: Role of Government and Promotional agencies in entrepreneurship development, Entrepreneurship Development Programmes

Reference Books:

- Khanka S.S., "Entrepreneurship Development". S.Chand.
- Desai, A N. "Entrepreneur & Environment". 1990. Ashish, New Delhi.
- Drucker, Peter. "Innovation and Entrepreneurship". 1985. Heinemann, London.
- Jain Rajiv. "Planning a Small Scale Industry: A Guide to Entrepreneurs". 1984. S.S. Books, Delhi.
- Kumar, S A. "Entrepreneurship in Small Industry". 1990, Discovery, New Delhi.
- McClelland, D C and Winter, W G. "Motivating Economic Achievement". 1969. Free Press, New York.
- Pareek, Udai and VenkateswaraRao, T. "Developing Entrepreneurship -A Handbook on Learning Systems". 1978, Learning Systems, Delhi.

Principal of Marketing and Management(OEC-25)	
No. of Credits: 3 L T P Total 3 0 0 3	Sessional: 40 Marks Theory :60 Marks Total :100 Duration of Exams: 3 Hours

UNIT-I :Introduction: concept, nature and significance of management; Functions of management, Levels of management and Managerial skills required at various levels, concept and process of human resource management, concept of marketing management and marketing mix, concept and major decisions of financial management.

UNIT-II: Process and types of planning, decision making process, basic issues in organizing types of organisation structure, delegation of authority and responsibility, departmentalisation, decentralization, span of management, line and staff relationship.

UNIT-III: Leadership styles/behaviours, leadership vs management; personal characteristics of effective leaders, theories of motivation; Maslow's Theory, Theory X and Y, Herzberg theory. management control – concept and process, managerial ethics and social responsibility

UNIT IV: Introduction to economics: micro vs macro economics. Relationship between science, engineering, technology and economic development. Meaning of Demand, Law of Demand, Elasticity of Demand. Law of Supply, Price equilibrium.

UNIT-V: Types of costs. Production function, Laws of production. Economies and diseconomies of scale. Market; types of market. Price equilibrium in perfect competition, monopoly, monopolistic competition, oligopoly.