

SCHEME and SYLLABUS
(Based on AICTE Model Curriculum)
for
BACHELOR OF TECHNOLOGY
in
MECHANICAL & AUTOMATION ENGINEERING
(w.e.f. session 2018-2019)



DEPARTMENT OF MECHANICAL ENGINEERING
J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA,
FARIDABAD



J. C. Bose University of Science and Technology, YMCA, Faridabad
(formerly YMCA University of Science and Technology)

A State Govt. University established wide State Legislative Act. No. 21 of 2009
SECTOR-6, FARIDABAD, HARYANA-121006



VISION

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

MISSION

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



Department of Mechanical Engineering

VISION

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

MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1:

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

PEO-2:

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

PEO-3:

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

PEO- 4:

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

**J.C.BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA,
FARIDABAD**

SYNOPSIS OF

SCHEME OF STUDIES & EXAMINATIONS

4 YEARS BACHELOR of TECHNOLOGY PROGRAMME

In

MECHANICAL& AUTOMATION ENGINEERING

SEMESTER I – VIII

(w.e.f. Session 2018-19)

B. TECH SCHEME CREDITS CALCULATIONS

S.No.	Category of Courses	Contact Hours	Credits
1.	Programme Core Courses (PCC)	71	63
2.	Basic Science Courses (BSC)	28	25
3.	Engineering Science Courses (ESC)	32	23
4.	Humanities and Social Sciences including Management Courses (HSMC)	4	3
5.	Programme Elective Courses (PEC)	15	15
6.	Open Elective Courses (OEC)	9	9
7.	Skill Enhancement Courses (SEC)	24	22
8.	Mandatory Audit Courses (MAC)	4	0
9.	Massive Open Online Courses (MOOCS)	0	0*
	Total	187	160

Note: * MOOCS course will be opted by students any time during their B. Tech programme to earn extra credits of maximum 20, to get honours in B.Tech.

SEMESTER WISE SUMMARY OF THE PROGRAMME

S.No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	25	650	19.5
2.	II	26	600	18.5
3.	III	32	900	28
4.	IV	28	750	21
5.	V	26	700	20
6.	VI	24	750	21
7.	VII/VIII	26	800	22
8.	VIII/VII	One Semester	500	10
	Total	187	5650	160

PROGRAMME CORE COURSES (PCC)

S.No.	Code	Name of the Course	No. of Contact Hours	No. of Credits	Semester
1.	PCC-MAE-201	Thermodynamics	3	3	III
2.	PCC-MAE-203	Strength of Material	4	4	III
3.	PCC-MAE-205	Fluid Mechanics and Machines	4	4	III
4.	PCC-MAE-207	Strength of Material Lab	2	1	III
5.	PCC-MAE-209	Fluid Mechanics and Machines Lab	2	1	III
6.	PCC-MAE-202	Applied Thermodynamics	4	4	IV
7.	PCC-MAE-204	Materials Engineering	3	3	IV
8.	PCC-MAE-206	Manufacturing Process	3	3	IV
9.	PCC-MAE-208	Manufacturing Machines	4	4	IV
10	PCC-MAE-210	Thermal Lab –I	2	1	IV
11	PCC-MAE-212	Materials Engineering Lab	2	1	IV
12	PCC-MAE-301	Heat and Mass Transfer	3	3	V
13	PCC-AME-302	CAD-CAM	3	3	VI
14	PCC-MAE-303	Theory of Machines	3	3	V
15	PCC-MAE-304	Mechatronics & Product Design	3	3	VI
16	PCC-MAE-305	Design of Machine Elements- I	4	4	V
17	PCC-MAE-306	Refrigeration & Air Conditioning	3	3	VI
18	PCC-MAE-307	Manufacturing Technology & Metrology	3	3	V
19	PCC-MAE-308	CAD-CAM LAB	2	1	VI
20	PCC-MAE-309	Theory of Machine Lab	2	1	V
21	PCC-MAE-310	Refrigeration & Air Conditioning Lab	2	1	VI
22	PCC-MAE-311	Heat & Mass Transfer Lab	2	1	V
23	PCC-MAE-401	Robotics Engineering	3	3	VII/VIII
24	PCC-MAE-403	Optimization Technique	3	3	VII/VIII
25	PCC-MAE-405	Robotics Engg Lab	2	1	VII/VIII
		Total	71	63	

MECHANICAL AND AUTOMATION ENGG.
(III – VIII SEM)

J.C.BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

**SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – III) MECHANICAL& AUTOMATION
ENGINEERING**

Sl.No.	Category	Code	Course Title	Hours per week			Credits	Marks		
				L	T	P		Sessional	Final	Total
1	Professional Core Courses	PCC-MAE 201	Thermodynamics	3	0	0	3	25	75	100
2	Basic Science Courses	BSC- 202	Mathematics III	3	0	0	3	25	75	100
3	Engineering Science Courses	ESC- 201	Basic Electronics Engineering	3	0	0	3	25	75	100
4	Engineering Science Courses	ESC- 203	Engineering Mechanics	3	1	0	4	25	75	100
5	Basic Science Courses	BSC- 205	Biology	3	0	0	3	25	75	100
6	Professional Core Courses	PCC-MAE 203	Strength of Materials	3	1	0	4	25	75	100
7	Professional Core Courses	PCC-MAE205	Fluid Mechanics and Machines	3	1	0	4	25	75	100
8	Professional Core Courses	PCC-MAE207	Strength of Materials Lab	0	0	2	1	15	35	50
9	Professional Core Courses	PCC-MAE209	Fluid Mechanics and Machines Lab	0	0	2	1	15	35	50
10	Skill enhancement Courses	SEC-WS-201	Workshop III	0	0	4	2	30	70	100
			Total	21	3	8	28	210	590	800

Note: Exams duration will be as under

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

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**SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – IV)**

MECHANICAL& AUTOMATION ENGINEERING

Sl.No.	Category	Code	Course Title	Hours per week			Credits	Marks		
				L	T	P		Sessional	Final	Total
1	Professional Core Courses	PCC-MAE 202	Applied Thermodynamics	3	1	0	4	25	75	100
2	Professional Core Courses	PCC-MAE 204	Materials Engineering	3	0	0	3	25	75	100
3	Professional Core Courses	PCC-MAE 206	Manufacturing Process	3	0	0	3	25	75	100
4	Professional Core Courses	PCC-MAE 208	Manufacturing Machines	3	0	0	3	25	75	100
5	Professional Core Courses	PCC-MAE 210	Thermal Lab	0	0	2	1	15	35	50
6	Professional Core Courses	PCC-MAE 212	Material Engineering Lab	0	0	2	1	15	35	50
7	Mandatory Courses	MC-02	Environmental Science	2	-	-	0	0	0	0
8	Skill enhancement Courses	SEC-WS-202	Workshop IV	0	0	4	2	30	70	100
			Total	14	1	8	17	160	440	600

Note: Exams duration will be as under

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

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FARIDABAD**

**SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – V)
MECHANICAL& AUTOMATION ENGINEERING**

Sl.No.	Category	Code	Course Title	Hours per week			Credits	Marks		
				L	T	P		Sessional	Final	Total
1	Professional Core Courses	PCC-MAE 301	Heat Transfer	3	0	0	3	25	75	100
2	Professional Core Courses	PCC-MAE 303	Theory of Machines	3	1	0	4	25	75	100
3	Professional Core Courses	PCC-MAE 305	Design of Machine Elements	3	1	0	4	25	75	100
4	Professional Core Courses	PCC-MAE 307	Manufacturing Technology & Metrology	3	0	0	3	25	75	100
5	Open Elective Courses	OEL-	Open Elective I	3	0	0	3	25	75	100
6	Professional Core Courses	PCC-MAE309	Heat Transfer Lab	0	0	2	1	15	35	50
7	Professional Core Courses	PCC-MAE 311	Theory of Machines Lab	0	0	2	1	15	35	50
8	Mandatory Courses	MC-03	Essence of Indian Traditional Knowledge	2	-	-	0	0	0	0
9	Skill enhancement Courses	SEC-WS-301	Workshop V (Project Based)	0	0	4	2	30	70	100
			Total	17	2	8	21	185	515	700

Note: Exams duration will be as under

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

J.C.BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

**SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – VI)**

MECHANICAL& AUTOMATION ENGINEERING

Sl.No.	Category	Code	Course Title	Hours per week			Credits	Marks		
				L	T	P		Sessional	Final	Total
1	Professional Core Courses	PCC-MAE 302	CAD/CAM & Automation	3	0	0	3	25	75	100
2	Professional Core Courses	PCC-MAE 304	Mechatronics & Product Design	3	0	0	3	25	75	100
3	Professional Elective Courses	PEC-MAE 322-332	Elective I	3	0	0	3	25	75	100
4	Professional Elective Courses	PEC-MAE 342-352	Elective-II	3	0	0	3	25	75	100
5	Professional Core Courses	PCC-MAE 306	Refrigeration & Air Conditioning	3	0	0	3	25	75	100
6	Professional Core Courses	PCC-MAE 308	CAD/CAM & Automation Lab	0	0	2	1	15	35	50
7	Professional Core Courses	PCC-MAE 310	Refrigeration & Air Conditioning Lab	0	0	2	1	15	35	50
8	Professional Core Courses	PCC-MAE 312	Mechatronics and product Design Lab	0	0	2	1	15	35	50
9	Open Elective Course	OEL-	Open Elective-II	3	0	0	3	25	75	100
10	Skill Enhancement Courses	SEC-WS 302	Workshop VI (Project Based)	0	0	4	2	30	70	100
Total credits				18	0	10	23	225	625	850

Note: Exams duration will be as under

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

	Course Code	Course Title
Professional Elective courses Elective-I	PEC-MAE302	Advance Manufacturing Processes
	PEC-MAE304	Internal Combustion Engines
	PEC-MAE306	Design of Transmission Systems
	PEC-MAE308	Gas Dynamics and Jet Propulsion
	PEC-MAE310	Principles of Management
	PEC-MAE312	Measurement & Instrumentation
Professional Elective courses Elective-II	PEC-MAE322	New Venture Creation
	PEC-MAE324	Welding Technology
	PEC-MAE326	Maintenance Engineering
	PEC-MAE328	Diagnostic Maintenance and Monitoring
	PEC-MAE330	Automatic Control
	PEC-MAE332	Visionary Learning in Manufacturing

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**SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4th YEAR (SEMESTER – VII)**

MECHANICAL& AUTOMATION ENGINEERING

Sl No	Category	Code	Course Title	Hours per week			Credi ts	Marks		
				L	T	P		Session al	Fin al	Tot al
1	Professional Core Courses	PCC- MAE401	Robotics Engineering	3	0	0	3	25	75	100
2	Professional Core Courses	PCC- MAE403	Optimization Technique	3	0	0	3	25	75	100
3	Professional Elective Cour ses	PEC- MAE 421-431	Elective III	3	0	0	3	25	75	100
4	ProfessionalE lective Courses	PEC- MAE 441-451	Elective IV	3	0	0	3	25	75	100
5	Professional Elective Cour ses	PEC- MAE 461-471	Elective V	3	0	0	3	25	75	100
6	Open Elective Cour ses	OEL-	Open Elective III	3	0	0	3	25	75	100
5	Professional Core Courses	PCC- MAE 405	Robotics Engg Lab	0	0	2	1	15	35	50
6	Skill Enhancement Courses	SEC- MAE 401	Project (Major)	0	0	4	2	30	70	100
7	Skill Enhancement Courses	SEC-WS 403	Workshop VII	0	0	4	2	30	70	100
Total credits				18	0	10	23	225	625	850

	Course Code	Course Title
Professional Elective courses Elective-III	PEC-MAE401	Industrial Control
	PEC-MAE403	Total Quality Management
	PEC-MAE405	Design and Optimization
	PEC-MAE407	Energy Conservation and Management
	PEC-MAE409	Marketing Management
	PEC-MAE411	Industrial Engineering
Professional Elective courses Elective-IV	PEC-MAE421	Flexible Manufacturing Systems
	PEC-MAE423	Project Management
	PEC-MAE425	Computer Integrated Manufacturing
	PEC-MAE427	Non-Conventional Energy Resources Utilization
	PEC-MAE429	System Modelling & Simulation
	PEC-MAE431	Product Design and Development

Note: Exams duration will be as under

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

PROGRAMME ELECTIVE COURSE-V (PEC-V) (Semester-VII/ VIII)

S.No.	Code	Name of Course	Contact Hours	Credits
1.	PEC-ME-441	Automobile Engineering	3	3
2.	PEC-ME-443	Numeric control of machine tools and robotics	3	3
3.	PEC-ME-445	Applied hydraulics and pneumatics	3	3
4.	PEC-ME-447	Microprocessors in automation	3	3
5.	PEC-ME-449	Mechanical vibrations	3	3
6.	PEC-ME-451	Automation in manufacturing	3	3

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**SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4th YEAR (SEMESTER – VIII)**

Semester VIII (Fourth Year)

Branch/Course: MECHANICAL & AUTOMATION ENGINEERING

Sl.No	Category	Course Code	Course Title	Hours per week			Credits	Marks		
				L	T	P		Sessional	Final	Total
1	Skill Enhancement Courses	SEC-MAE 402	Industrial Training	0	0	20	10	200	300	500
			Total				10	200	300	500

Open Elective courses Open Elective-I	Department	Course Code	Course Title
	Computer Department	OEL-CE-201	Intelligent Systems
		OEL-CE-202	Cyber laws and Security
		OEL-CE-203	Soft Computing
		OEL-CE-204	Web Technology and Information Retrieval
		OEL-CE-205	Intellectual Property and Rights

Open Elective courses Open Elective-II	Department	Course Code	Course Title
	Electrical Department	OEL-EL-301	Installation Testing & Maintenance of Electrical Equipments
		OEL-EL-302	Utilization of Electrical Power & Traction
	Electronics Department	OEL-EE-303	Microprocessor and Interfacing
		OEL-EE-304	Digital Signal Processing
		OEL-EE-305	Instrumentation and Control
		OEL-EE-306	Data Communication and Networking

Open Elective courses Open Elective-III	Department	Course Code	Course Title
	Humanities & Social Sciences Including Management Courses	OEL-HM-401	Industrial Psychology
		OEL-HM-402	Economics
		OEL-HM-403	Finance & Accounting
		OEL-HM-404	Human Resource Management
OEL-HM-405		Entrepreneur Development	

	L	T	P	Credits	Sessional	Final	Total
Total (Sem. 1 to	106	18	62	160	1535	401	555

8)

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0

Courses offered by Civil Engineering Department

	Department	Course Code	Course Title
Open Elective-III	CIVIL ENGG.	OE-CI-	Environmental Engineering
		OE	Traffic Engineering and Management
		OE	Contracts Management
		OE	Solid and Hazardous Waste Management
		OE	Air and Noise Pollution and Control

cedure for Annual Exam and Continuous Assessment of Industrial Training:

(A) Annual Exams Marks

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

(B) Continuous Assessment Marks

- | | |
|-------------------------------------|-----------|
| 1. Assessment by University Faculty | 50 Marks |
| 2. Assessment by Industrial Guide | 50 Marks |
| 3. Conduct Marks | 100 Marks |

Total: 500 Marks

PCC-MAE-201 THERMODYNAMICS
B. Tech (Mechanical Engineering) III Semester

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

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

Pre- Requisite: Nil

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

Course Objectives:

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

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

1. Understand the basic concepts of thermodynamics and apply energy balance to systems and control volumes, in situations involving heat and work interactions.
2. Analyze performance of energy conversion devices and cycles.
3. Evaluate properties of pure substances, gases and their mixtures in various processes.
4. Learn to differentiate between high grade and low grade energies and understand the II law limitations on energy conversion.

Course Contents:

Unit 1:

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. (5)

Unit 2:

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy. (5)

Unit 3:

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Constant temperature and Constant pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam

tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart. (8)

Unit 4:

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. (5)

Unit 5:

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale. (5)

Unit 6:

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.(8)

Unit 7:

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle. (4)

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

PCC-MAE-203
STRENGTH OF MATERIALS
B. Tech (Mechanical Engineering) III Semester

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

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

Pre- Requisite: Elementary Engineering Mechanics

Successive: Advance Strength of Materials, Machine Design

Course Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
- To calculate the elastic deformation occurring in various simple geometries for different types of loading.
- **Course Outcomes:**
 1. To recognise nature of internal stresses that will develop within the components
 2. To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
 3. To make out concept of Moment of Inertia
 4. Analysis of Torsion of various shafts
 5. Analysis of Axial & Hoop Stress.

Course Content:

Unit 1:

Deformation in solids- Hooke's law, stress and strain tension, compression and shear stresses elastic constants and their relations- volumetric, linear and shear strains-principal stresses and principal planes- Mohr's circle. (8)

Unit 2 :

Shear Force and Bending diagram: Beams and types transverse loading on beams- shear force and bend moment diagrams, Types of beam supports, simply supported and overhanging beams, cantilevers. Theory of bending of beams, bending stress

distribution and neutral axis, shear stress distribution, point and distributed loads. (8)

Unit3:

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems. (8)

Unit4: Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs. (8)

Unit5: Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure (8)

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, TataMcGrawHill Publishing Co. Ltd., New Delhi 2005.

PCC-MAE-205 FLUID MECHANICS AND FLUID MACHINES

B. Tech(Mechanical & Automation Engineering) III Semester

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

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

Pre- Requisite: Nil

Successive: Heat and Mass Transfer

Course Objectives:

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

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

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

CO 4- Analyse flows through pipes and open channels.

CO5- Evaluating performance of pumps and turbines.

Course Contents :

Unit 1:

Definition of fluid, Newton's law of viscosity, Units and dimensions- properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications. (9)

Unit 2:

Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness Darcy Weisbach equation, friction factor, Moody's diagram. (9)

Unit 3:

Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis. (6)

Unit 4:

Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles Centrifugal pumps, wor

king principle, work done by the impeller, performance curves Cavitation in pumps-
Reciprocating pump – working principle. (8)

Unit 5:

Classification of water turbines, heads and efficiencies, velocity triangles-

Axial, radial and mixed flow turbines Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube-Specific speed, unit quantities, performance curves for turbines – governing of turbines. (8)

Text Books:

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

Reference Books:

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

ESC- 201 BASIC ELECTRONICS ENGINEERING

B. Tech III Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Physics

Successive: Mechatronics, Automation in Manufacturing

Course Objectives:

To provide an overview of electronic device components to Mechanical engineering students.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

Course Contents:

Unit 1:

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Unit 2:

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

Unit 3:

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Unit 4:

Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Unit 5:

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Text /Reference Books:

1. Floyd ,” Electronic Devices” Pearson Education 9th edition, 2012.
2. R.P. Jain , “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd Edition, 2001

ESC-202 ENGINEERING MECHANICS

B. Tech III Semester

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

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

Pre- Requisite: Physics, Mathematics

Successive: Kinematics of Machines, Dynamics of Machines, Strength of Materials

Course Objectives:

The objective of this Course is to provide an introductory treatment of Engineering Mechanics to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters.

Course Outcomes: After the completion of this course, the students will be able to;

CO 1- Understand the basic force system equilibrium

CO 2- Apply principles of friction in engineering problems.

CO 3- Expedite concept of Structure analysis.

CO 4- Explore Centroid and virtual work concept

CO5 - Review of particle dynamics

CO6 - Develop of Kinetics of Rigid Bodies

Course Content:

Unit 1:

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static In-determinacy.

Unit 2:

Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

Unit 3:

Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Unit 4:

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of

inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Unit 5:

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Unit 6:

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit 7:

Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
5. Reddy Vijaykumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics
6. Bansal R.K. (2010), A Text Book of Engineering Mechanics, Laxmi Publications
7. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
8. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

BSC 202 MATHEMATICS III

B. Tech III Semester

No. of Credits: 3

L T P Total

3 3 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Mathematics I and II

Successive: Engineering Mechanics, Operations Research

Course Objectives:

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To provide an overview of probability and statistics to engineers.

Course Outcomes: After the completion of this course, the students will be able to;

- CO1: solve field problems in engineering involving PDEs.
- CO2: formulate and solve problems involving random variables
- CO3: apply statistical methods for analysing experimental data.
- CO4: understand the concept of probability.

Course Contents:

Unit 1:

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. (14 hours)

Unit 2:

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.(12 hours)

Unit 3:

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. (12 hours)

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

BSC 01: BIOLOGY
B. Tech III Semester

No. of Credits: 3
L T P Total
3 00 3

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

Pre- Requisite: Nil

Successive: Environmental Science

Course Objectives:

To Learn the Basic concept of Biology related to Engineers, Genetics, Biomolecules, Enzymes, Information Transfer, Macromolecular analysis, Metabolism, Microbiology

Course Outcomes (COs) : After the completion of this course, the students will be able to;

1. Classify enzymes and distinguish between different mechanisms of enzyme action.
2. Identify DNA as a genetic material in the molecular basis of information transfer.
3. Analyze biological processes at the reductionist level
4. Apply thermodynamic principles to biological systems.
5. Identify and classify microorganisms.

Unit 1: Introduction

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Unit 2: Classification

Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Unit 3: Genetics

Purpose: To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics.

Emphasis to be given not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Unit 4: Biomolecules

Purpose: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Unit 5: Enzymes

Purpose: To convey that without catalysis life would not have existed on earth. Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Unit 6: Information Transfer

Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Unit 7: (5 hours). Macromolecular analysis

Purpose: How to analyse biological processes at the reductionistic level. Proteins- structure and function. Hierarchy in protein structure. Primary, secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Unit 8: (4 hours)- Metabolism

Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Unit 9: (3 hours)- Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

Textbooks/ References:

- 1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
- 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
- 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
- 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
- 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

PCC-ME-207 STRENGTH OF MATERIALS LAB
B. Tech (Mechanical & Automation Engineering) III Semester

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

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

Pre- Requisite: Strength of Materials

Successive: Machine Design

Course Objectives:

The objective of the Mechanics of Solid lab is to demonstrate the basic principles in the area of strength and mechanics of materials and structural analysis

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

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

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

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

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

List of Experiments:

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

PCC-ME-209: FLUID MECHANICS & MACHINES LAB

B. Tech (Mechanical & Automation Engineering) III Semester

No. of Credits: 1

L T P Total

0 0 2 2

Sessional: 15 Marks

Practical: 35 Marks

Total : 50 Marks

Duration of Exam: 02 Hours

Course Objectives:

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

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

CO 1- Understand the concept of venturimeter and orifices.

CO 2- Learn continuity and Bernoulli's equation.

CO 3- Analyse discharge measuring devices and hydraulic coefficients.

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

CO5- Able to understand hydraulic Machines; Pumps, turbines, Gear oil pump

List of Experiments:

1. To verify the Bernoulli's Theorem.
2. To determine coefficient of discharge of Venturimeter & Orificemeter.
3. To determine the coefficient of discharge of a Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of contraction, velocity and discharge of an orifice.
6. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
7. To draw the constant head; constant-speed and constant efficiency curves of Pelton turbine.
8. To draw the constant head; constant speed and constant efficiency curves of Francis turbine
9. To draw the constant head; constant speed and constant efficiency curves of Kaplan turbine.
10. To study the constructional details and draw the characteristic curves of Centrifugal pump
11. To draw the characteristic curves of Reciprocating pump.

12. To Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe

SEC-ME- 201 WORKSHOP –III
B.Tech- III Semester

No. of credits: 2
L T P Total
0 0 4 4

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

Pre-requisite: Turning, Milling, Welding, Refrigeration & air conditioning.

Successive: Conventional machines, welding, refrigeration & air conditioning etc.

Course Objectives: To understand mechanical engineering by introduction of conventional machines, Welding, Refrigeration & Air Conditioning.

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

- CO 1-** Understand the safety measures of mechanical workshop.
- CO 2-** Learn the functions of various conventional machines, arc & gas, metal inert gas/metal active gas (MIG/MAG) arc welding techniques.
- CO 3-** Prepare different jobs by turning and milling operation.
- CO 4-** Perform different operations in refrigeration & air conditioning shop.
- CO 5-** Perform different welding operations.

List of Exercises:

(Turning, Milling, Welding and Refrigeration & Air Conditioning Workshop)

1. To understand various safety measures, working principle & specifications of various conventional machines (lathe, milling, shaper, grinder etc).
2. To study elements of single point cutting tools and multiple point cutting tools.
3. To prepare single point brazed tool with carbide tip on a mild steel shank involving milling and brazing operation.
4. To prepare a job involving centering, facing, plain turning and step turning.
5. To prepare a job by machining on milling/ shaper machine and surface grinding on surface grinder.
6. To prepare a straight continuous bead in different current setting in flat position by arc welding on a mild steel plate.
7. To prepare straight continuous bead run on mild steel plate in flat position by MIG/MAG arc welding.
8. To set oxy-acetylene plant for flames and fusion run without filler rod (flat position) by gas welding.
9. To create fillet weld in lap joint on mild steel plate in flat position by arc welding .
10. To study refrigeration and air conditioning tools and refrigeration cycles.
11. To study different types of refrigerant use in refrigeration cycle.
12. To perform cutting and flaring operation of ferrous and non ferrous tubes.
13. To perform Swaging and Brazing of ferrous and non ferrous tubes.

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

(Workshop related to MAE may be introduced as per institute requirements)

PCC-ME 202 APPLIED THERMODYNAMICS
B. Tech (Mechanical & Automation Engineering) IV Semester

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

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

Pre- Requisite: Thermodynamics

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

Course Outcomes: After the completion of this course, the students will be able to;

1. Get a good understanding of various practical power cycles and heat pump cycles.
2. Analyze energy conversion in steam turbines and learn about the types and heating values of fuels.
3. Understand phenomena occurring in high speed compressible flows.
4. Evaluate the performance of reciprocating compressors.

Course Contents:

Unit 1:

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions Heat calculations using enthalpy tables Adiabatic flame temperature chemical equilibrium and equilibrium composition calculations using free energy. (8)

Unit 2:

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle Gas power cycles, Air standard Otto, Diesel and Dual cycles- Air standard Brayton cycle, effect of reheat, regeneration and inter cooling - Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties. (12)

Unit 3:

Properties of dry and wet air, use of psychrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point. (4)

Unit 4:

Basics compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows - normal shocks- use of ideal gas tables for isentropic flow and normal shock flow Flow of steam and refrigerant through nozzle, super saturation- compressible flow in diffusers, efficiency of nozzle and diffuser. (8)

Unit 5:

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. (5)

Unit 6:

Analysis of steam turbines, velocity and pressure compounding of steam turbines (3)

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals of Thermodynamics*, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.
4. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd

PCC-ME-204 MATERIALS ENGINEERING
B. Tech((Mechanical &Automation Engineering) IVSemester

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

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

Pre- Requisite: Chemistry

Successive: Advanced Solids of Mechanics, Machine Design

Course Objectives:

Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.

Course Outcomes (COs)

After the completion of this course, the students will be able to;

- CO1. Understand the basics of structure, imperfection and deformation of crystalline materials
- CO2. Define various mechanical properties of materials and recognize methods of their measurement
- CO3. Discuss mechanisms/theories of failure and get acquainted with fracture mechanics under static/dynamic loads
- CO4. Explain methods of heat treatment of steels, draw transformation diagrams and interpret microstructure development
- CO5. Appreciate concept of solid solutions and interpret binary phase diagrams, especially the Fe-C system
- CO6. Describe properties of ferrous and non-ferrous alloys

Course Contents:

Unit 1:

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. (6)

Unit 2:

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength. (6)

Unit 3:

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to non-destructive testing (NDT) (8)

Unit 4: Alloys, substitutional and interstitial solid solutions Phase diagrams: Interpretation of binary phase diagrams and micro structure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron. (6)

Unit 5:

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening (6)

Unit 6:

Alloying of steel, properties of stainless steel and tool steels, maraging steels cast irons; grey, white, malleable and spheroidal cast irons copper and copper alloys; brass, bronze and cupronickel Aluminium and AlCu Mg alloys Nickel based superalloys and Titanium alloys (8)

Text Books:

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering", Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

PCC-MAE-206 MANUFACTURING PROCESSES
B.Tech ((Mechanical &Automation Engineering) IV Semester

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

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

Pre- Requisite: Nil

Successive: Manufacturing Technology, Welding Technology

Course Objectives:

To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional methods.

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

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

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

CO 3- Analyze the mechanics of chip formation and to identify the factors related to tool wear, machinability and cutting tool materials.

CO4- Learn about different machining tools and processes like turning, milling, drilling, gear cutting and additive manufacturing.

CO5- Acquire knowledge about basic welding processes and their selection for fabrication of different components.

Course Contents:

Unit 1:

Conventional machining processes: Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. (5)

Unit 2:

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy. (5)

Unit 3:

Metal cutting: Single and multi-point cutting; Orthogonal cutting system, various force components: Chip formation, merchant circle, velocity relationship Tool wear and tool life, Economics of metal cutting, Surface finish and integrity, Machinability, Evaluation of machinability index.

Unit 4:

Cutting tool materials: requirement of cutting tool material, classification of tool material Cutting fluids: functions of cutting fluids, requirement of good cutting fluids, Types of cutting fluids (4)

Unit 5:

Gear manufacturing methods: different gear manufacturing methods, gear hobbing, gear shaping, gear forming, gear finishing methods. (5)

Turning, Drilling, Milling and finishing processes, Introduction to CNC machining. (3)

Unit 6:

Additive manufacturing: Rapid prototyping and rapid tooling. (3)

Unit 7:

Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding. (4)

Text Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition) Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing
4. Amitabh Ghosh and Asok Kumar Mallik, Manufacturing Science, Affiliated East-West Press Private Limited.

PCC-MAE 208 MANUFACTURING MACHINES
B. Tech. IV Semester(Mechanical &Automation Engineering)

No. of Credits: 3

L T P Total

3 0 0 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory: 75 Marks

Total: 100 Marks

Course Objectives: The Objective of the paper to facilitate to student with manufacturing process using Machine tools in use today and its application in different type of industry.

Course Outcomes: After studying this course, students will be able to;

1. Understand the working of lathe machine tool,
2. Know the basic concepts of NC and CNC machine tool programming and computer aided part programming
3. Understand the working of shaper machine tool
4. Understand the working of Planner machine .
5. Understand the working of machine tools such as milling, hobbing, and grinding.

Contents:

UNIT I Introduction : Classification of machine tools based on application and production rate :General purpose. Single and Special purpose machines, Classification based on types of machine tools and the processes, Generation and forming.Elements of metal cutting processes : Elements of tool geometry, cutting tool material and applications.

UNIT II Lathe : Various types of lathe : Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, CNC lathe, major difference between CNC lathe and conventional lathe. Major sub-assemblies of a Lathe : Bed, headstock, tail stock, carriage consisting of saddle, cross slide, tool post and apron. Work holding devices : self centering three jaw chuck, independent four jaw chuck, collets, face plates dog carriers, centers and mandrels.

UNIT III Lathe contd... Driving mechanisms, apron mechanism, thread cutting mechanism and calculations, features of not engagement – disengagement, indexing dial mechanism.Operations on lathe : taper turning, related calculations, thread cutting, facing, under cutting, drilling, boring, parting-off, knurling, chamfering

UNIT IV Reciprocating Type Machine Tools : Shaper, Planer and Slotter : Constructional features, basic machines and kit and related calculations Drilling Machine, multi spindle drilling machine, feed mechanism, work hold holding devices, tool holding devices. Different drilling operations: Drilling reaming, counter boring and countersinking etc. estimation of drilling time.

UNIT V Milling Machines : Types of general purpose milling machine : horizontal, vertical and Universal. Types of milling cutters and their applications, different indexing. Indexing calculations and machining time calculations. Introduction to machining centers.

UNIT VI Grinding Machines : Different type of grinding machines : cylindrical, surface and center-less grinding machines, basic constructional features and mechanisms, specifications, different grinding operations, honing, lapping and super finishing processes.

Text Books:

1. P.N. Rao, "Manufacturing Technology: Metal Cutting & Machine Tools", Tata Mc Graw Hill Delhi, 2004
2. B.S. Raghuwanshi "Workshop Technology, Vol 2, Dhanpat Rai & Sons.
3. Hazar Chandhari S.K "Elements of Workshop Technology, Vol 2, Media Promoters, 2003.

Reference Books

1. P.C Sharma "A Text Book of Production. Engineering, S. Chand, New Delhi, 2004
2. Bawa H.S "workshop Technology, Vol 2 Tata Mc Graw Hill 2004.
3. Juneja & Shekhon; Fundamental of Metal Cutting, New age publications.
4. S.F Krar Stevan F and Check A.F Technology of M/C Tools" Mc Graw Hill Book Co. 1986.
5. Kibbe Richard et al "M/c Tool practices "Prentice Hall India, 2003.
6. Bangalore HMT. "Production Technology". Khanna Publishers.
7. R.K Jain "Production Technology". Khanna Publishers.
8. Gerling Heinrich "All about Machine Tools" New Age Publication. 2003

PCC-MAE212 MATERIAL ENGINEERING LAB

B. Tech (Mechanical & Automation Engineering) IV Semester

No. of Credits: 1

L T P Total

0 0 2 2

Sessional: 15 Marks

Theory : 35 Marks

Total : 50 Marks

Duration of Exam: 2 Hours

Pre- Requisite: Material Science

Successive: Metallurgy

Course Objectives:

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

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

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

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

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

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

List of Experiments:

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

MC-02: Environmental Science

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

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

Course Outcomes (CO)

1. To provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities.
2. To identify the natural resources and suitable methods for their conservation and sustainable development.
3. To focus importance of ecosystem and biodiversity for maintaining ecological balance.
4. To learn about various attributes of pollution management and waste management practices.
5. To describe the social issues both rural and urban environment and environmental legislation.

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 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---- 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: insitu 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.

TEXT/ REFERENCES

1. "Perspectives in Environmental Studies" by A. Kaushik and C. P. Kaushik, New age international publishers.
2. "Environmental Studies by Benny Joseph", Tata McGraw Hill Co, New Delhi
3. "Environmental Science: towards a sustainable future" by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
4. "Environmental Engineering and science" by Gilbert M. Masters and Wendell P. Ela 2008 PHI Learning Pvt Ltd.
5. "Environmental Science" by Daniel B. Botkin& Edwards A. Keller, Wiley INDIA edition.
6. "Fundamentals of Ecology" by Odum, E.P., Barrick, M. and Barret, G.W. Thomson Brooks/Cole Publisher, California, 2005

EC-ME-202 WORKSHOP-IV

B.Tech - IV Semester

No. of credits: 2
L T P Total
0 0 4 4

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

Pre-requisite: Turning, Milling, Welding, Refrigeration and air conditioning.

Successive: Conventional machines, arc, gas, metal inert gas/metal active gas (MIG/MAG) arc welding & refrigeration and air conditioning etc.

Course Objectives: To understand the basics of mechanical engineering by conventional machines, welding, refrigeration and air conditioning and exercises.

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

CO 6- Perform various operations on lathe, milling, shaper, drilling and grinding machines.

CO 7- Understand the function and use of various metrological tools and gauges.

CO 8- Create various jobs by arc, gas, MIG/MAG welding.

CO 9- Dismantling and assembly of compressors and identify various parts of compressor.

List of Exercises:

(Turning, Milling, Welding & RAC Workshop)

14. To perform multi operational job (facing, centering, turning, knurling, threading, grooving, chamfering etc) on lathe machine.
15. To understand the use of various metrological tools and gauges such as bore gauge, micrometer (inside and outside), slip gauge, sine bar, snap gauge and plug gauge etc.
16. To perform a job of taper machining/V-shape machining on milling/shaping machine.
17. To perform grinding of multi point cutting tool (milling cutters) on tool and cutter grinder.
18. To lay weaved bead & prepare T-joint in flat position by arc welding on mild steel plate.
19. To prepare closed butt joint on mild steel plate in flat position by MIG/MAG welding.
20. To perform cutting operation in mild steel plate by oxy-acetylene gas welding.
21. To prepare a raised edge joint without filler metal rod by gas welding.
22. Dismantling and assembling of single cylinder compressor.
23. Dismantling and assembling of dual cylinder reciprocating compressor.
24. Dismantling and assembling of rotary open & closed type compressor.
25. To perform gasket cutting for single & dual cylinder, rotary open & close type compressor.

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

(Institute can frame workshop related to MAE)

PCC-MAE: 301 HEAT TRANSFER

B. Tech. V Semester(Mechanical &Automation Engineering)

No. of Credits: 3

Sessional: 25 Marks

L T P Total

Theory: 75 Marks

3 0 0 3

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: Thermal Lab- II, Design of Thermal Systems

Course Objectives:

- The aim of the course is understand the concept of Heat Transfer such as; conduction, convection and radiation, analysis, and design of heat exchangers.

Course Outcomes: After the completion of this course, the students will be able to;

1. To formulate and analyze of the three modes of heat transfer.
2. Obtaining exact solutions for the temperature variation
3. Designing of devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.
4. Conceptualization of mode of mass transfer.

Course Contents :

Unit1:

Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.(12)

Unit 2:

Heat convection,basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection. (8)

Unit 3:

Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.(8)

Unit 4:

Types of heat exchangers, Analysis and design of heat exchangers using bothLMTD and ϵ -NTU methods.(6)

Unit 5:

Boiling and Condensation heat transfer, Pool boiling curve (3)

Unit 6:

Introduction and modes of mass transfer, Mass and mole concentrations, , molecular diffusion, eddy diffusion, fick's law, General equation of mass diffusion in stationary media, Diffusion of water vapours through air, Convective mass transfer and it's correlations. (3)

Text Books:

1. A. Bejan, Heat Transfer John Wiley, 1993
2. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.
4. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002
5. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002

PCC-MAE303 THEORY OF MACHINES

B.Tech (Mechanical & Automation Engineering) IV Semester

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

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

Pre- Requisite: Engineering Mechanics

Successive: Machine Design

Course Objectives:

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

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

CO 1- Develop the concept of mechanism and machines.

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

CO 3- Development the concept of Synthesis of Mechanisms.

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

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

CO 6- Knowledge of concept of Mechanical Governor

Syllabus:

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

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

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

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

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

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

Text Books:

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

References:

1. NPTL lectures

PCC-MAE305 DESIGN OF MACHINE ELEMENT
B. Tech (Mechanical & Automation Engineering) V Semester

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

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

Pre- Requisite: Kinematics of Machines, Mechanics of Solids

Successive: Machine Design

Course Objectives:

To study the concept and details of material selection, allowable stresses and factor of safety. To study the design of keys, coupling, cotter joints, various types of springs, various types of clutches, thick cylinder and thin cylinders.

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

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

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

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

CO 4- Design procedure of transmission of shafts.

CO 5- Design of different types springs.

CO 6- Learn in depth knowledge of flywheels and their design.

Syllabus:

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

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

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

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

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

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

Text Books:

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

Web Links:

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

PCC-MAE-307 MANUFACTURING TECHNOLOGY AND METROLOGY

B. Tech (Mechanical & Automation Engineering) IV Semester

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

Pre- Requisite: Manufacturing Process

Successive: Welding Technology, Production Planning and Control

Course Objectives:

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

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

- CO 1-** Acquire knowledge about mechanics of chip formation and to identify the factors related to tool wear and machinability.
- CO 2-** Learn about different gear manufacturing and gear finishing operations.
- CO 3-** Select the proper cutting tool material and components of jigs and fixtures.
- CO 4-** Understand the basics principles of non-conventional machining processes and their applications.
- CO 5-** Identify and select different measuring instruments for the inspection of different components.

Syllabus:

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

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

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

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

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

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

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

Text Books:

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

Reference Books:

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

Web Links:

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

PCC-MAE309 HEAT TRANSFER LAB

B.Tech (Mechanical & Automation Engineering) V Semester

No. of Credits: 1

Sessional: 15 Marks

L T P Total

Theory : 35 Marks

0 0 2 2

Total : 50 Marks

Pre- Requisite: Heat Transfer

Successive: Power Plant Engineering

Course Objectives:

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

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

CO 1- Understanding the conduction heat transfer coefficient.

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

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

CO 4- Knowledge of development about mass transfer.

List of Experiments:

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

PCC-MAE311 THEORY OF MACHINES LAB

B. Tech (Mechanical & Automation Engineering) V Semester

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

Pre- Requisite: Theory of Machines

Successive: Mechanical Vibration.

Course Objectives:

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

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

CO 1- Understand the various practical demonstrations of mechanism.

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

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

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

List of Experiments:

1. To study various types of kinematic links, pairs, chains and mechanisms.
2. To study inversions of four bar mechanism, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To generate spur gear involute tooth profile using simulated gear shaping process.
6. To study various types of gears- Helical, cross helical worm and bevel gear.
7. To study various types of gear trains – simple, compound, reverted, Epicyclic and differential.
8. To study types of CAM & followers, to draw the Cam Profile.
9. To Prepare performance characteristic Curves, and to find stability & sensitivity on Proell, Porter Governors and Hartnell Governor
10. To carry out static balancing on static balancing machine

MC 03: Essence of Indian Knowledge Tradition Pt-I

भारतीयविज्ञानासार – 1

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

Course objective

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

Course Contents Basic structure of Indian Knowledge System: अर्वादेशिविज्ञाना-षवेद, षउपवेद (आयुर्वेद, धनुर्वेद, - गृहविज्ञानवेद, थापन विज्ञान) षवेदांग (विज्ञान, कर्म, विनियोग, प्रवृत्ति, उचित, छंद) ष उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र) Modern Science and Indian Knowledge System– Yoga and Holistic Health care– Case studies–

References

- 1) V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya, Vidya Bhavan, Mumbai. 5th Edition, 2014
- 2) Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan•
- 3) Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan•
- 4) Fritzof Capra, Tao of Physics
- 5) Fritzof Capra, The Wave of life• VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay• Foundation, Velliarnad, Arnakulam Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
- 6) GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya,
- 7) Vidyanidhi Prakashan, Delhi 2016 RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi
- 8) Prakashan, Delhi 2016 P B Sharma (English translation), Shodashang Hridayan
- 9) Pedagogy: Problem based learning, group discussions, collaborative mini projects. Outcome: Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

SEC-ME- 301-WORKSHOP – V
B.Tech - V Semester

No. of credits: 2
L T P Total
0 0 4 4

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

Pre-requisite: Turning, Milling, Welding, Refrigeration and air conditioning.

Successive: Conventional and non conventional machines, CNC machines, arc, metal inert gas/metal active gas(MIG/MAG) arc welding & refrigeration and air conditioning etc.

Course Objectives: To understand the mechanical engineering by conventional and non conventional machines, welding, and refrigeration and air conditioning exercises.

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

CO-1-Understand the function and use of CNC machines, broaching machine and electric discharge machine (EDM) .

CO 2- Perform various operations on lathe & milling machines.

CO 3- Develop the part program for machining component on CNC machining center and turning center.

CO 4- Prepare jobs on arc, metal inert gas/metal active gas (MIG/MAG), and oxy-acetylene gas welding.

CO 5- Dismantling and assembly of single phase A.C motor assorted relay and capacitor.

CO 6-Testing of various electrical devices to be used in air conditioners and coolers.

List of Exercises:

(Turning, Milling, Welding & RAC Workshop)

1. To prepare a slot/keyway in a component on milling / shaper machine.
2. To study working principle and parts of broaching and electric discharge machine.
3. To study main features and parts of CNC machining center and turning center.
4. prepare part program for machining component on
5. To prepare a job on lathe machine including facing, centering, plain turning, taper turning, threading, drilling and chamfering operations.
6. To prepare straight continuous bead inside/outside corner joints in flat position on mild steel plate by arc welding.
7. To prepare lap joint in flat position on mild steel plate by MIG/MAG welding.
8. To perform brazing on copper sheet to copper pipe with copper brazing filler metal/rod by gas welding.
9. To perform brazing on mild steel sheet to mild steel pipe with brass filler metal/rod by gas welding.
10. To study, dismantling, assembling and troubleshooting of single phase A.C motor.
11. To study assorted relays, capacitors and their testing along with applications.
12. To study and tracking out various electrical circuits used in room and desert coolers.
13. To study testing and uses of assorted selector switches.

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

PCC-MAE302 CAD / CAM AND AUTOMATION

B. Tech. VI Semester (Mechanical & Automation Engineering)

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Course Objectives:

To study the fundamentals of CAD and CAE for Design and development of mechanical systems and familiarize the students with the advanced machines like NC, CNC, DNC and robotics. To study the basic steps in manufacturing a component on a CNC machine.

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

1. Understand the basic fundamentals of computer aided designing.
2. Learn Transformations and types of surfaces
3. Understand the basics of NC, CNC, DNC and adaptive control systems.
4. Develop CNC programs to manufacture industrial components.
5. Acquire knowledge about advanced manufacturing systems like FMS and CIM.
6. Knowledge of basic principle and elements of automation and control in manufacturing.

Content:

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

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

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

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

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

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

Text Books:

1. Rao, P.N., CAD / CAM Principles and Applications, McGraw Hill Publishers, New Delhi, 2010.
2. M.P.Groover, Automation, production systems and Computer-integrated Manufacturing, Eastern Economy Edition.
3. Salomon, D. *Transformations and projections in computer graphics* Springer.

Reference Books:

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

PCC-MAE 304 MECHATRONICS AND PRODUCT DESIGN

B. Tech. VI Semester (Mechanical & Automation Engineering)

No. of Credits: 3

Sessional: 25 Marks

L T P Total

Theory: 75 Marks

3 0 0 3

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Basic Electronic Engineering

Successive: Advanced Manufacturing System

Course Objectives:

The main objective of this course is to understand the concept and interfacing of various hardware in mechatronics design of mechanical products and to study control system for effective functioning of mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.

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

- 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.

Content:

UNIT I Introduction and Basics: Introduction, Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers; The Mechatronic Approach.

Hardware of Measurement Systems; A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / along with Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Inverting Amplifiers, Non inverting Amplifiers, Summing, Integrating, Differential, Logarithmic Amplifiers Protection; Filtering; Wheat Stone Bridge; Digital Signals; Multiplexers; Problems.

UNIT II Pneumatic, Hydraulic, Mechanical and Electrical Actuation Systems: Pneumatic and Hydraulic Systems; Directional Control Valves; Valve Symbols; Pressure Control Valves; Cylinder Sequencing; Process Control Valves; Rotary Actuators; Mechanical Systems – Types of Motion, Kinematic Chains, Cams, Gear Trains,

Ratchet & Pawl, Belt & Chain Drives, Bearings, Mechanical Aspect of Motor Selection; Electrical Systems; Mechanical & Solid State Switches; Solenoids; D.C. & A.C. Motors; Stepper Motors; Problems.

UNIT III System Modeling and Performance: Engineering Systems; Rotational – Translational Systems; Electro-mechanical Systems; Hydraulic – Mechanical Systems; A review of modeling of First and Second Order Systems and Performance Measures; Transfer Functions for first order System, Second Order System, Systems in series & Systems with Feedback Loops; Frequency Response of First Order and Second Order Systems; Bode Plots: Performance Specifications: Stability; Problems.

UNIT IV Hydraulic & Pneumatic Actuation Systems: Fluid power systems, hydraulic systems, Pneumatic systems, system structure and signal flow, hydraulic pumps and Pressure Control Valves and regulation, air compressors and treatment, Cylinders, Direction Control Valves, Process control valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.

UNIT V Digital Logic and Programmable Logic Controllers : A Review of Number Systems & Logic Gates; Boolean Algebra; Karnaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems.

UNIT VI Microprocessors and Input/ Output Systems: Control; Microcomputer Structure; Micro- controllers; Applications; Programming Languages; Instruction Sets; Assembly Language Programs; Subroutines; Why C Language ? A review of Program Structure, Branches, Loops, Arrays, Pointer; Examples of Programs; Interfacing; Input/ Output; Interface Requirements; Peripheral Interface Adaptors; Serial Communication Interface; Examples of Interfacing; Problems.

Design and Mechatronics: Design Process; Traditional and Mechatronics Design; Possible Mechatronics design solutions for Timed Switch, Wind Screen Wiper Motion, Bath Room Scale, A Pick & Place Robot, Automatic Camera, Engine Management System & Bar Code Recorder.

Text Books:

1. Mechatronics by W. Bolton, Published by Addison Wesley.
2. Mechatronics System Design – Devdas Shetty and Richard A. Kolx Brooks/ Cole 1997.

Reference Books:

1. Introduction to Mechatronics and Measuring System: david G. Alciation and Michael B. Hits and Tata McGraw Hill
2. Mechatronics – Sensing to Implementation - C.R.Venkataraman, Sapna

PCC-MAE306 REFRIGERATION & AIR CONDITIONING

B. Tech (Mechanical & Automation Engineering) VI Semester

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

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

Pre- Requisite: Thermodynamics

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

Course Objectives:

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

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

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

Syllabus:

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

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

UNIT II Simple Vapour Compression (VC) Refrigeration Systems: Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on P-V, T-S and PH diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

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

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

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

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

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

Text Books:

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

Reference Books:

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

PCC-MAE308 CAD / CAM AND AUTOMATION LAB
B. Tech. VI Semester(Mechanical &Automation Engineering)

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

Pre- Requisite: CAM and Automation

Successive: Mechatronics

Course Objectives:

To understand the fundamentals of CAD and CAE for design and development of mechanical systems & develop domain knowledge in the field of CNC and robotics. To prepare and execute the program for different components on CNC machine.

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

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

CO 2- Explore the surface and solid modeling features.

CO 3- Identify different axes, machine zero, home position of CNC machines.

CO 4- Prepare part program for drilling, machining and turning operations on CNC machine.

List of Experiments:

1. Introduction to CATIA/ Solidworks and working with sketch mode
2. Working with creating features (Extrude & Revolve), Axis and Planes.
3. Working with the tools like Hole, Round, Chamfer and Fillet.
4. Working with the tools like Pattern, Copy, Rotate, Move and Mirror.
5. Working with advanced modeling tools (Sweep, Blend, Variable section Sweep, Swept Blend & Helical Sweep).
6. To get knowledge of various safety points in CNC Lab
7. To perform step turning and facing on MS component using CNC turning centre
8. To perform taper turning on MS component using CNC turning centre
9. To perform OD grooving on MS component using CNC turning centre
10. To perform external threading operation on MS component using CNC turning centre
11. To perform top milling and side milling on MS component using CNC machining centre
12. To perform drilling operation on MS component using CNC machining centre
13. To cut an intricate shape on wire cut- CNC Machine

PCC-MAE310 REFRIGERATION & AIR CONDITIONING LAB

B. Tech. VI Semester (Mechanical & Automation Engineering)

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

Pre- Requisite: Refrigeration and Air-conditioning

Successive: Air Conditioning Equipments

Course Objectives:

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

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

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

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

CO 3- Understand functioning of various control devices

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

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

1) List of Experiments:

2) To determine the C.O.P. and draw P-H and T-S diagrams for the vapour compression Refrigeration System.

3) To find the C.O.P. of the Mechanical heat pump.

4) To find the C.O.P. of the Air and Water heat pumps.

5) To study the cut-sectional models of Reciprocating and Rotary Refrigerant compressor.

6) To analyze the various controls used in Refrigerating & Air Conditioning systems.

7) To find the C.O.P. and capacity of an Ice- plant.

8) To analyze the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.

9) To find the C.O.P. of vapour absorption system.

10) To find the performance parameters of the cooling tower.

11) To find the C.O.P of Water Cooler.

12) To study the chilling plant and its working cycle.

13) To study and find the By Pass factor of heating & cooling coils & plot them on psychrometric chart for different inlet conditions.

PCC-MAE312 MECHATRONICS & PRODUCT DESIGN LAB

B. Tech. VI Semester (Mechanical & Automation Engineering)

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

Pre- Requisite: Mechatronics and Product Design

Successive: Advanced Manufacturing System

Course Objectives:

The main objective of this course is to understand the concept and interfacing of various hardware in mechatronics design of mechanical products and to study control system for effective functioning of mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.

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

- CO 1-** Generate conceptual design for Mechatronics products based on potential custom requirements.
- CO 2-** Select appropriate sensors and actuators.
- CO 3-** Design a control system for effective functioning of Mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.
- CO 4-** Develop system model for mechanical system.
- CO 5-** Understand hardware tools to build mechatronics system.

List of Experiments:

1. Study of DC valves and actuators and develop pneumatic circuits to sequence A+A-, A+B+A-B-;
2. Develop Electro –pneumatic sequencing circuits in sequence - A+A-, A+B+A-B-;
3. Develop pneumatic circuits to sequence A+A- B+B-, A+B+C+A-B-C-; A+B+B-A-;
4. Develop Electro –pneumatic sequencing circuits in sequence - A+A-B+B-; A+B+B-A-;
5. Study a simulation software for simulating ladder diagram for a PLC and make AND/OR/NAND/ NOR / XOR logic.
6. Simulate ladder diagram on a PLC software for using flags, latch(s), timer(s), counter(s), registers.
7. Wire an industrial PLC and program it for AND/ OR/ NAND / XOR logic.
8. Wire and industrial PLC and program for using flags, latch(s), timer(s), counter(s), Integers.
9. Introduction to SCADA and HMI programming

SEC ME- 302- WORKSHOP- VI
B.Tech- VI Semester

No. of credits: 2
L T P Total
0 0 4 4

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

Pre-requisite: Turning, Milling, Welding, Refrigeration and air conditioning.

Successive: Conventional and non conventional machines, arc, metal inert gas/metal active gas (MIG/MAG), tungsten inert gas (TIG) arc welding ,gas welding & refrigeration and air conditioning etc .

Course Objectives: To understand the mechanical engineering by conventional and non conventional machines, welding, refrigeration and air conditioning and exercises.

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

CO 10- Cut gears on a work piece by gear hobbing/gear shaper.

CO 11- Create various jobs on conventional lathe, milling/shaper and CNC turning center.

CO 12- Prepare various jobs by Arc, MIG/MAG, TIG and Gas welding techniques.

CO 13- Learn troubleshooting of all metering devices, testing of leakage in refrigeration system and electrical wiring of coolers, deep freezers and room air conditioners.

List of Exercises:

(Turning, Milling, Welding & RAC Workshop)

26. To prepare a job consisting of drilling, tapping, recessing/spline, chamfering operations etc on milling/shaper and drilling machine.
27. To prepare a bush on lathe machine (facing, drilling, boring, turning, chamfering operations etc).
28. To perform gear cutting operation by gear hobbing/gear shaper.
29. To prepare the part program for machining a mild steel component on CNC turning center.
30. To prepare straight continuous bead in upward and downward direction in vertical position and closed butt joint in horizontal position on mild steel plate by arc welding.
31. To prepare T-fillet joint in flat position on mild steel plate by MIG/MAG welding.
7. To prepare straight continuous bead on stainless steel/aluminum sheet by TIG welding.
8. To prepare butt joint in flat position on mild steel sheet with mild steel copper coated (MSCC) filler rod by gas welding.
9. To find out the storage capacity of a refrigerator.
10. To study different types of metering devices along with their dismantling and assembling procedures and troubleshooting.
11. To identify leakage in a refrigeration system.
12. To perform electrical wiring of refrigerators, coolers, deep freezers, multi-temperature units and room air conditioners.

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

PCC-MAE 401 ROBOTICS ENGINEERING

B. Tech. VII Semester(Mechanical &Automation Engineering)

No. of Credits: 3

Sessional: 25 Marks

L T P Total

Theory: 75 Marks

3 0 0 3

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Theory of Machine

Course Objectives:

Students will demonstrate an understanding of how to program *robots* and computers that control manufacturing automation,

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

- Familiar with the history, concept development and key components of *robotics* technologies.
- Familiar with various *robot* sensors and their perception principles that enable a *robot* to analyse their environment, reason and take appropriate actions toward the given goal.
- Understand, analyse and solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning. .
- Design and implement a robotic project on a physical mobile robot platform, with tasks involving project specification, algorithm design, software programming, simulation and modelling, control and obstacle avoidance in a complex and interactive environment.
- Make self-learning/adaptive control systems for *robots/intelligent* systems

Content:

UNIT I ROBOTIC MANIPULATION: Automation and robots; Robot classification - Drive , Technilgies, work-envelope Geometries, motion control method, Applications; Robot Specification- No. of axis, capacity and speed, reachand stroke. tool orientation, Repeatability, precision, accuracy, operation environment, An example; Rhino X-3

UNIT IIDIRECT KINEMATIC: The arm equation homogenous co-ordinate- frames, translation and rotation, composite homogenous transformation; screw transformation; link Co-ordinates; the arm equation: A five axis Articulated robot: A four axis SCARA robot, A six axis articulated robot

UNIT III INVERSE KINEMATIC: solving the arm equation: the inverse kinematic problem; general properties of solution; tool configuration; inverse kinematic of a five axis articulated robot, four axis scara robot, A six axis articulated robot and three axis planner articulated robot; a robotic workcell; problems

UNIT IV WORKSPACE ANALYSIS AND TRAJECTORY PLANNING: work space analysis; work envelope of a five axis articulated robot; work envelope of a four axis SCARA robot, work space fixture, the pick and place operation, continues path motion; interpolated motion, straight line motion; problems

UNIT V DIFFERENTIAL MOTION AND STATICS: The tool configuration jacobian matrix; joint- space singularities; generalized inverse, resolved-motion rate control; $n > 6$; rate control of redundant robot: $n > 6$; rate control using (D)inverse; the manipulator jacobian; induced joint torques and forces ; problems

UNIT VI MANIPULATOR DYNAMIC: Lagrange's equation; Kinetic and potential energy; generalized force; lagrange-euler dynamic model; Dynamic model of a two axis planer articulated robot and a three axis SCARA robot; direct and inverse dynamic; Recursive newton-euler formulation, Dynamic model of a one axis robot; problems

Text books

1. Fundamental of robotics(analysis and control) by robert J. Schilling published by PHI
2. Introduction to robotics (mechanism and control) by John J. Craig, published by Addition wesley.

Reference book

A robotic engg text book-Mohsen shahinpur, harper & low, publishing new york

PCC-MAE403 OPTIMIZATION TECHNIQUES

B. Tech. VII Semester (Mechanical & Automation Engineerin)

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Numerical Methods

Successive: Project Management

Course Objectives:

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

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

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

Syllabus:

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

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

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

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

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

UNIT VI Game Theory: Two person zero-sum games. Minimax and Maximin principle. Arithmetic, Algebraic, Matrix Algebra method. Solution by Dominance, Subgame, Graphical method, Linear programming method

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

Text Books:

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

Reference Books:

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

Web Links:

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

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

SEC-ME-401-WORKSHOP – VII
B.Tech-VII Semester

No. of credits: 2
L T P Total
0 0 4 4

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

Pre-requisite: Turning, Milling, CNC, Welding, Refrigeration and air conditioning.

Successive: Lathe, milling, CNC, arc, gas, metal inert gas/metal active gas (MIG/MAG) arc welding, resistance welding, submerged arc welding (SAW) & refrigeration and air conditioning etc.

Course Objectives: To understand the mechanical engineering by conventional and non-conventional machines, metal cutting & welding by arc, MIG/MAG, resistance and refrigeration and air conditioning.

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

CO 14-Prepare jobs on lathe and milling machine.

CO 15-Develop various jobs using arc, resistance, MIG/MAG and Submerged Arc welding (SAW).

CO 16-Understand the fundamentals of refrigeration and air conditioning rigs and cold storage plants.

CO 17-Rectify some electrical and mechanical faults in window & split type air conditioners.

CO 18-Prepare some jobs by machining it on CNC wire cut EDM.

List of Exercises:

(Turning, Milling, CNC, Welding & RAC Workshop)

1. To perform eccentric turning on a component using lathe machine.
2. To perform taper cutting on dead center using lathe machine.
3. To perform radius cutting on milling machine using rotary table.
4. To develop a cavity on a component using CNC wire cut EDM.
5. To prepare padding bead in flat position and closed butt joint in vertical upward/downward position on mild steel plate by arc welding.
6. To prepare corner joint on mild steel plate in flat position by MIG/ MAG welding.
7. To prepare lap joint on mild steel sheet using Spot/Seam/projection welding.
8. To prepare straight continuous bead on mild steel plate in flat position using SAW.
9. To calculate C.O.P and capacities of industrial refrigeration rig, cold storage plant, split air conditioner rig and room air conditioner rig.
10. To identify and rectify the electrical and mechanical faults in window & split type air conditioners.
11. To flush dehydrate and evacuate the refrigeration system.
12. To pull down the temperature of cold storage plant to specific temperature.

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

PCC-MAE405 ROBOTICS ENGINEERING LAB

B.Tech. VII Semester (Mechanical & Automation Engineering)

No. of Credits: 1

L T P Total

0 0 2 2

Sessional: 15 Marks

Theory : 35 Marks

Total : 50 Marks

Pre- Requisite: Computer Aided Design

Successive: Design and Optimisation

Course Objectives:

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

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

CO 1- Apply the programming method of robotic system.

CO 2- Handle the working of an CNC and robotic system

CO 3 - Understand and able to analyse and solve problems in spatial coordinate

CO – 4 Understanding concept of representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning

CO -5 To knowledge about Robotics intelligent system

List of Experiments:

1. To study various type of Robotics configuration
2. To study SCARA Robot.
3. To get knowledge of various safety points in Robotics Lab
4. To teach robotic arm a point in space by using teach pendant
5. To draw a triangle in particular frame by using KR-16 robotic arm
6. To draw the above triangle in different frame with the same To teach robotic arm a point in space by using teach pendant programme
7. To make a complicate shape involving arcs by using teach pendant
8. To make a complicate shape involving circles by using teach pendant
9. To construct an array of 3*3 by using robotic arm
10. To construct an array of 4*4 by using robotic arm

PROFESSIONAL ELECTIVE COURSE

PEC-MAE-302: ADVANCE MANUFACTURING PROCESSES (Elective – I)

B. Tech (Mechanical and Automation Engineering) VI Semester

No. of Credits: 3

L T P Total

3 0 0 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Pre-requisite: Thermodynamics

Successive: None

Course Objectives:

The main objective of this course is to get knowledge about non traditional machining process and understand theory involved material removal mechanism.

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

1. Acquire knowledge about non traditional machining process.
2. Study the different process parameters and differentiate between various non traditional machining processes.
3. Identify suitable non traditional machining process.
4. Understand various material removal mechanisms.

UNIT-I Material Removal Processes: Introduction, history of machining, traditional machining processes, non traditional machining processes, hybrid machining processes. need for non-traditional machining processes.

UNIT-II Mechanical Processes: Ultrasonic machining - Introduction, the machining system, material removal process, factors affecting material removal rate, dimensional accuracy and surface quality, applications. Water jet machining - Introduction, The machining system, Process parameters, Applications, Advantages and disadvantages of WJM, Abrasive Jet Machining - Introduction, Machining system, Material removal rate, Applications, Advantages and limitations of AJM.

UNIT-III Chemical Processes: Chemical Milling - Introduction, Tooling for CHM, Process parameters, Material removal rate, Accuracy and surface finish, Advantages, Limitations, Applications Photochemical Milling - Introduction, Process description Applications, Advantages Electro Polishing - Introduction, Process parameters, Applications, Process limitations.

UNIT IV Electrochemical Processes: Electro Chemical Machining: Introduction, Principles of electrolysis, Theory of ECM, ECM equipment, Basic working principles, Process characteristics, Process control, Applications Basics of Electrochemical Drilling, Electro-Chemical Deburring, and Electro stream drilling.

UNIT V Hybrid Electrochemical Processes: Electro Chemical Grinding - Introduction, Material removal rate, Accuracy and surface quality, Applications, Advantages and disadvantages Electrochemical Honing - Introduction, Process characteristics, Applications Electrochemical Super Finishing - Introduction, Material removal process, Process accuracy Electrochemical Buffing - Introduction, Material removal process.

UNIT VI Thermal Processes: Introduction, Mechanism of material removal, Thermal machining system, Material removal rates, Heat-affected zone, Applications. Wire EDM/Surface EDM principle, Process parameters, surface finish and machining accuracy, applications. Laser beam machining - Introduction, material removal mechanism, applications, advantages and limitations. Electron beam machining - introduction, basic equipment and removal mechanism, applications, advantages and disadvantages. Plasma beam machining - introduction, machining systems, material removal rate, accuracy and surface quality, applications, advantages and disadvantages. Ion beam machining - introduction, material removal rate, accuracy and surface effects, applications.

Text Books:

1. Pandey P.C. and Shah H.S, "Modern Machining Processes", TMH.
- 2 El-Hofy, Hassan Abdel-Gawad, "Advanced Machining Processes: Non traditional and Hybrid Machining Processes", McGraw-Hill.

References:

1. Bhattacharya A, "New Technology, the Institution of Engineers", India
- 2.V. K. Jain, "Advanced Machining Processes", Allied Publisher

PEC-MAE-304: INTERNAL COMBUSTION ENGINES (Elective – I)

B. Tech (Mechanical and Automation Engineering) VI Semester

No. of Credits: 3

L T P Total

3 0 0 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Objectives:

1. To familiarize with the terminology associated with IC engines.
2. To understand the basics of IC engines.
3. To understand combustion, and various parameters and variables affecting it in various types of IC engines.
4. To learn about various systems used in IC engines and the type of IC engine required for various applications

Course Contents: Review of ideal cycles; Details of fuel-air cycles. Combustion in SI and CI engines, Combustion stages, Combustion chambers and Abnormal combustion. Fuel supply systems in SI and CI engines, carburettors, Port fuel injection, Direct injection and Common rail injection. Ignition system, Lubrication system and Cooling system. Testing of IC engines. Engine emissions and control. Advanced IC Engine concepts.

Course Outcomes:

Students who have done this course will have a good idea of the basics of IC engines and how different parameters influence the operational characteristics of IC Engines

Text Books:

1. Obert E. F, "Internal Combustion Engines and Air Pollution", Harper and Row Publication Inc. NY, 1973.
2. Heisler H, "Advanced Engine Technology", Edward Arnold, 1995.
3. Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989
4. Heldt P. M, "High Speed Combustion Engines", Oxford & IBH publishing Co. India, 1985.
5. Stockel M W, Stockel T S and Johanson C, "Auto Fundamentals", TheGoodheart, Wilcox Co. Inc., Illinois, 1996.

PEC-MAE-306: DESIGN OF TRANSMISSION SYSTEMS (Elective – I)

B. Tech (Mechanical and Automation Engineering) VI Semester

No. of Credits: 3

L T P Total

3 0 0 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Course Objectives:

The main objective of this course is to design different tools used in the industries for metal cutting, metal forming, work piece holding and inspection purposes.

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

- CO1-** Select and use different cutting tools and their materials according to machining operations and work piece materials.
- CO 2-** Select the material and design different gauges.
- CO 3-** Design jigs and fixtures for conventional and NC machining.
- CO 4-** Understand the concepts of press tools.
- CO 5-** Design single point and multipoint cutting tools

Course Contents:

UNIT I Tool Geometry, Tool & Work Piece Material: Common work and Tool materials, Tool inserts, Specifications of inserts and tool holders, Physical principle in metal cutting: Chip formation and types of chips, work done in cutting, BUE on metal cutting, curling & contraction of chip, work hardening, quality of machines surfaces.

UNIT II Basic Principles of Tool Design: Tool design – An overview, signature of single point tools, Design of single point turning tool, ISO tool shapes, design of flat and circular form tools, milling cutter.

UNIT III Introduction to Jigs and fixtures, Work holding devices: Basic principle of six point location, Locating methods and devices, Principle of clamping and Types of clamps, Design of jigs: Type of Drill bushes, Classification of drill jigs, Design of drill jigs, Design of fixtures: Design of milling fixtures.

UNIT IV Press Working Operations: Types of Presses, Tonnage required, Blanking Tool and parts, Piercing Tool, Progressive Tool and parts, strip layout, scrap calculation for Blanking and Piercing operations.

UNIT V Brief introduction of CNC machines work holding devices: Tool design for CNC machines, Fixture design for CNC Machine, Cutting tools for CNC Machine, Tool holding methods for CNC Machine, ATC and APC for CNC Machine, Tool presetting for CNC Machine.

UNIT VI Gauges and Gauge Design: introduction, elements and their function, Design of Plug Gauges and Ring Gauges, Standards, materials for gauges, maintenance and safety of gauges.

Text Books:

1. Fundamentals of Tool Design – Donaldson – TMH
2. Theory of Metal Cutting and Tool Design – Arshinov – Mir Publishers, Moscow

Reference Books:

1. Fundamentals of Tool Design- ASTM
2. Tool Design- H.W, Pollack – Tarapoueva
3. Jigs and fixtures - P. H. Joshi – McGraw Hill
4. An introduction to Jigs and Fixtures- M.HA Kempster – Whitaker & Sons Ltd.
5. Fundamentals of Tool Design, F.W. Wilson, ASME, PHI, New Delhi

PEC-MAE-308: GAS DYNAMICS AND JET PROPULSION (Elective – I)

B. Tech (Mechanical and Automation Engineering) VI Semester

No. of Credits: 3

L T P Total

3 0 0 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Pre- Requisite: Thermodynamics, Applied Thermodynamics

Successive: Aircraft Technology

Course Objectives:

To understand the features of compressible isentropic flows and irreversibilities like shocks.

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

1. To apply gas dynamics principles to jet and space propulsion systems.
2. To understand concept of Non-isentropic flow
3. To familiarise with rocket engines
4. To get acknowledge of Nozzle and diffuser.

Course Contents:

Unit1:

Compressible flow, definition, Mach waves and Mach cone, stagnation states, Mass, momentum and energy equations of one-dimensional flow, Isentropic flow through variable area ducts, nozzles and diffusers, subsonic and supersonic flow in variable area ducts, choked flow, Area-Mach number relations for isentropic flow

Unit2:

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables

Unit3

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines.

Unit 4;

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights

Text Books:

1. Ahmed F. El-Sayed, Aircraft Propulsion and Gas Turbine Engines, CRC Press, 2008.
2. H.S. Mukunda, "Understanding Aerospace Chemical Propulsion", Interline Publishing, 2004.
3. Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992.
4. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975.
5. Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986.

PEC-MAE-310: PRINCIPLES OF MANAGEMENT (Elective – I)

B. Tech (Mechanical and Automation Engineering) VI Semester

No. of Credits: 3

L T P Total

3 0 0 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Objectives:

To understand the principles of management and their application to the functioning of an organization

Contents:

Definition of management, science or art, manager vs entrepreneur; Types of managers - managerial roles and skills; Evolution of management-scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and Decentralization, job design, human resource management, HR Planning, Recruitment selection, training & development, performance management, career planning and management.

Directing individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

Controlling, system and process of controlling, budgetary and non-budget control technique, use of computer and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Course Outcomes:

Upon completion of this course, the students will get a clear understanding of management functions in an organization

Text Books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.

2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.

PEC-MAE 312: MEASUREMENT AND INSTRUMENTATION

B. Tech. VI Semester (Mechanical & Automation Engineering)

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: None

Successive: Automatic Control

Course Objectives:

This module introduces the learner to the principles of measurement and calibration using a range of instruments. It will include the theory and principles of operation of instrumentation pertaining to process and other industries. The learner will also calibrate a selection of relevant transducers.

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

- Describe the operation of transducers for strain, acceleration
- Describe the operation of Temperature Measurement.
- Explain the essential measurement & instrument parameters-accuracy, precision, repeatability, sensitivity, resolution, range, hysteresis etc.
- Describe the principles of operation of level, pressure, temperature and flow measurements
- To introduce students to monitor, analyze and control any physical system.

Content:

UNIT I

Instruments and Their Representation : Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration. Static and Dynamic characteristics of Instruments : Introduction, Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead Band, Backlash, Drift, Formulation of Differential Equations for Dynamic Performance- Zero Order, First Order and Second order systems, Response of First and Second Order Systems to Step, Ramp, Impulse and Harmonic Functions.

UNIT II

Transducer Elements : Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamic, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, PiezoElectric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical

Transducers, Photo Conductive Transducers, Photo Volatic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

UNIT III

Motion, Force and Torque Measurement : Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter. Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements,

UNIT IV

Pressure Measurement: Introduction, Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing.

UNIT V

Flow Measurement : Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

UNIT VI

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Text Books :

1. Measurement systems Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (Fourth Edition) 2002.
2. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker.

Reference Books :

1. Principles of Measurement and Instrumentation – Alan S. Morris Prentice Hall of India.

2. Mechanical Measurements : T.G. Beckwith, W.L. Buck and R.D. Marangoni Addison Wesley.
3. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, TMH.
4. Mechanical Measurements by D. S. Kumar, Kataria& Sons.

PEC-MAE322: NEW VENTURE CREATION (Elective – II)

B. Tech (Mechanical and Automation Engineering) VI Semester

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

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

Pre- Requisite: Industrial Engineering

Successive: Production Planning and Control

Course Objectives:

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

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

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

Syllabus:

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

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

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

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

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

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

Text Books:

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

Reference Books:

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

PEC-MAE324: WELDING TECHNOLOGY (Elective – II)

B. Tech (Mechanical & Automation Engineering) VI Semester

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

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

Pre- Requisite: Manufacturing Process

Successive: Project work

Course Objectives:

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

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

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

Syllabus:

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

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

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

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

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

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

Text Books:

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

Reference Books:

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

PEC-MAE326: MAINTENANCE ENGINEERING (Elective – II)

B. Tech (Mechanical & Automation Engineering) VI Semester

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

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

Course Objectives:

The objective of the course is to provide the students with the fundamental concepts, the necessary knowledge and the basic skills related to systems maintenance function. The course intends to expose the students to the concept of maintenance optimal policies.

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

CO1: Understand the maintenance function and its objectives

CO2: Gain the necessary knowledge about the types of maintenance and know how to use them to design maintenance systems

CO3: To understand the condition monitoring and optimal maintenance policies.

CO4: To understand basic concepts of TPM.

Unit I Maintenance Management

Relevance of Maintenance: an over view, maintenance services, problems of the plant manager, automation and maintenance. Requirements of Maintenance Engineering Department, Basic Principles of maintenance Engineering — Importance and benefits of sound Maintenance systems –Maintenance organization – Definitions and terms used in Maintenance Engineering.

Unit II. Classification of maintenance approach

Introduction, Planned Maintenance- Unplanned Maintenance, Preventive Maintenance- Corrective Maintenance- Basic Principle and objective, advantages, disadvantages, Basic requirements.

Unit-III: Condition Monitoring- Different condition monitoring Techniques; Visual, performance, fluid and vibration monitoring. Fluid condition and particle monitoring; Wear debris analysis; Vibration monitoring methods; Vibration data collection; Techniques; Instruments.

Unit IV Optimal Maintenance Policies

Introduction, Factors affecting the maintenance policies, Maintenance categories – Comparative merits of each category, Repair/Discard decisions-Factors affecting the R/D

decisions, Cost comparison for R/D decisions, optimal module size, safety in Maintenance, Economics of maintenance.

Unit V: Total Productive Maintenance

Development and scope of concept, terotechnology, basic systems of TPM procedure and steps of TPM, productivity circle

Text Book and References

1. Industrial Maintenance – H.P.Garg
2. Ind. Maint. Management – S.K.Srivastava
3. Collacot R.A.- Mechanical fault diagnosis and condition monitoring
4. Hunt, T.M., (1993), Handbook of wear debris analysis and particle detection in liquids, Elsevier applied science, London and New York
5. Dhillon, B.S. (2002). Engineering Maintenance: A Modern Approach. CRC Press, Boca Raton, Florida.
6. Jardine, A.K.S. and Tsang, A.H.C. (2006). Maintenance, Replacement, and Reliability: Theory and Applications. CRC Press, Taylor & Francis Group, ISBN 0-8493-3966-0.
7. Rao, B. (1996), Handbook of condition monitoring, Elsevier advanced technology, Oxford.
8. Ross, S.M. (1970). Applied Probability Models with Optimization Applications. Holden Day, San Francisco.

PEC-MAE328: DIAGNOSTIC MAINTENANCE & MONITORING (Elective – II)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VI Semester

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

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

Objective:- The objective of the subject is the comprehensive solution to integrated diagnosis of systems with many components (Modules, Boards, Replacement units etc.) that is subject to failure.

Course Outcomes:-At the end this course, the students will be able to:

CO1: Understand significant advantages in relation to quality, safety, availability and cost reduction in industrial plants.

CO2: Apply decision making processes involved such as the selection of the most suitable diagnostic techniques.

CO3: Analyze the failure of equipment and various condition monitoring techniques

CO4: Understand the various vibration monitoring techniques and total productive maintenance

Unit 1 Maintenance Management

Relevance of Maintenance: an over view, maintenance services, problems of the plant manager, automation and maintenance.

Unit 2 Maintenance Importance

Maintenance objectives and costs, quality and quality circle in maintenance, engineering reliability, maintainability

Unit 3 Failure analysis

Defect generation types of failures, FTA, FMEA, FMECA Maintenance Types/systems
Planned and unplanned maintenance, breakdown, corrective, opportunistic, routine, preventive, predictive, CBM, Design out maintenance

Unit 4 Condition monitoring

NDT concepts, visual and temperature monitoring, leakage monitoring, vibration monitoring, lubricant monitoring methods

Unit 5 Equipment's used for condition monitoring

Equipment's, ferrography, spectroscopy, cracks monitoring, thickness monitoring, corrosion monitoring, noise monitoring, sound monitoring, smell monitoring

Unit 6 Total productive maintenance

Development and scope of concept, zero technology, basic systems of TPM procedure and steps of TPM, productivity circle

REFERENCE BOOKS:

- 1) Maintenance planning and control- Kelly, A., Butterworth & Co., 1984
- 2) Maintenance and spare parts Management–Krishanan, G, Prentice Hall–1991

PEC-MAE330: AUTOMATIC CONTROLS (Elective – II)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VI Semester

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

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

Pre- Requisite: Measurement & Instrumentation

Successive: Design and Optimisation,

Course Objectives:

1. Provide basic knowledge on practical control system and PLC applications.
2. Ensure the knowledge on applications of machines & electronic devices with control systems.

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

CO 1- Strong knowledge of MATLAB software.

CO 2- Do various engineering projects..

CO 3- Formulate transfer function for given control system problems.

CO 4- Find time response of given control system model

CO 5- Plot Root Locus and Bode plots for given control system model.

Content:

UNIT I

Introduction And Applications: Types of control systems ; Typical Block Diagram : Performance Analysis;Applications – Machine Tool Control, Boiler Control, Engine Governing, Aerospace Control, Active Vibration Control; Representation of Processes & Control Elements – Mathematical Modeling. Block Diagram Representation, Representation of Systems or Processes, Comparison Elements; Representation of Feedback Control systems – Block Diagram & Transfer Function Representation, Representation of a Temperature, Control System, Signal Flow Graphs, Problems.

UNIT II

Transient And Steady State Response: Time Domain Representation; Laplace Transform Representation; System with Proportional Control; Proportional – cum – Derivative control; Proportional – cum – Integral Control; Error Constants; Problems.

UNIT III

Frequency Response Analysis: Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots: Equivalent Unity Feed Back Systems; Problems.

UNIT IV

Stability Of Control Systems : Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion, Gain & Phase Margins: Problems.

UNIT V

Root Locus Method : Introduction; Root Ioci of a Second Order System; General Case; Rules for Drawing Forms of Root Ioci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems.

UNIT VI

State Space Analysis Of Control Systems: Introduction; Generalized State Equation; Techniques for Deriving System State – Space Equations; Transfer Function from State Equations; Solution of State Vector Differential Equations; Discrete Systems; Problems.

Text Books :

1. Theory & Applications of Automatic Controls by B.C. Nakra, Published by New Age International Pvt.

Ltd. Publishers, New Delhi.

2. Modern Control Engg. by Ugata, Prentice Hall of India, New Delhi.

Reference Books :

1. Automatic Control Systems by Kuo' Published by Prentice Hall of India, New Delhi.

2. Control System Engineering, I. J. Nagrath and M. Gopal, New Age , New Delhi

PEC-MAE-332: VISIONARY LEARNING IN MANUFACTURING

B. Tech (Mechanical & Automation Engineering)

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

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

CO 1- Understand the SMEs and VLCI concept.

CO 2- Explore the concept of 3S and flow line observation.

CO 3- Learn about Lean concept.

CO 4- Knowledge V-map 2& 3

CO 5- Development and understanding Hie- Junka plan

Chapter 1. Introduction Manufacturing system; SMEs and their characteristics; Challenges of small and Medium Industries; Introduction to VLCI; Visionary Leadership; Quality of good leadership; Challenges to lead SMEs; Motivation and Attitude. .

Chapter 2. Observation Skill : Cleanininess in factory, Introduction to 3S, Method of implementation of 3 S; result review technique of 3S; Application of 3 S and its advantages. Concept of Ergonomics, , Material Flow line; Optimisation of Material Handling equipments.

Chapter 3. Concept of Lean, JIT and Agile Manufacturing; V-map technique of observation; Preparation of Flow chart of V-map 1; Evaluation of V-map 1; Tier concept, typical Tier structure, Benefits of V mapping , Challenges with V-mapping.

Chapter 4. V map 2: Standardise work principle; Productivity improvement; Tree of Productivity; Introduction to V-map 3; steps for drawing V-map3; Cycle time and its calculation; Preperation of SWCT chart.

Chapter 6: Introduction to Hie-Junka planning. Methodology of Hie-Junka review and control. Concept of ZED (Zero defect Zero effect), Model of Maturity Assessment, Case studies of Indian study, A comparative study of Indian and Japan's model of quality programme, Understanding of Kizen.

Text Book

1. Observation skill by :Sharad Anerao, Anand Group
2. Study material Developed by VLICI

Refence Book;

1. A Revolution in Manufacturing: The SMED System: Single-minute Exchange of Die System : shigeo Shingo
- 2.The Six Sigma Way: How to Maximize the Impact of Your Change and Improvement Efforts : Peter Pande, Robert Neuman, Roland Cavanagh Level - Wiley
3. Toyota Production System: Beyond Large-Scale Production : Taiichi Ono

PEC-MAE401 INDUSTRIAL CONTROLS(Elective – III)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

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

Pre- Requisite: Basic Electronics Engineering, CAD/CAM and Automation

Successive: None

Course Objectives:

To study essential concepts of various types of automation, sensors and actuators. To study automated material handling system. To study various types of programmable logic controllers.

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

CO 1-Understand about programmable logic controllers.

CO 2-Complete understanding about communication networks for automation.

CO 3- Expedite the role of human factors in a project.

CO 4-Knowledge of various types of sensors and actuators for various applications.

CO 5- Exploration of flexible manufacturing system for making variety of components.

Content:

UNIT I Introduction: Meaning and need of automation, Types of automation: fixed, programmable, flexible, and integrated automation.

UNIT II Components of Automation: Actuators, controllers, sensors. Actuators;Solenoids and torque motors, Hydraulic and pneumatic actuators, valves and circuits. Sensors;characteristics, contact and non-contact type, Pressure switches, proximity and position sensors. Encoders, resolvers, synchros. Vision systems; Components of vision systems, image, camera, image capturing systems. Processing systems Bar coding and other identification systems. Controllers;Digital and analog control, open and closed loop control, servosystems, servosystem analysis and response, control configuration

UNIT III Logic Control and PLCs: Logic control, logic control elements, Programmable logic controllers: Applications, architecture, operation, and programming of PLCs. Typical applications.

UNIT IV Automated Material Handling Systems: Automated flowlines, transfer mechanisms, conveyors, robots, Automated guided vehicles; categories, guiding technologies and control. Automated Storage and Retrieval Systems, categories and components.

UNIT V Automated Inspection Systems: In process gauging systems, Co-ordinate measuring machines: Construction, operational modes and different probes.

Factory communication: interface standards, communication networks, LAN, WAN, Protocols: OSI and MAP.

UNIT VI Flexible Manufacturing Systems: Types, components, architecture and control.

Computer integrated manufacturing.

Text Books:

1. GrooverMikell “Automated Production Systems, and Computer Integrate Manufacturing” / PHI, 1992
2. Morriss, S. Brian, “Automated Manufacturing Systems”, GlanncoeMcgra, International Series, 1995.

PEC-MAE403: Total Quality Management *B. Tech*
(MECHANICAL & AUTOMATION ENGINEERING) *El III*

VII Semester

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

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

Objectives:

To facilitate the understanding of total quality management principles and processes

PEC-MAE422 Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1-Understand about programmable logic controllers.

CO 2-Complete understanding about communication networks for automation.

CO 3- Expedite the role of human factors in a project.

CO 4-Knowledge of various types of sensors and actuators for various applications.

CO 5- Exploration of flexible manufacturing system for making variety of components.

Contents:

Introduction, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention; costs to quality.

TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement; PDCE cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

The seven traditional tools of quality; New management tools; Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; FMEA- stages, types.

TQM tools and techniques, control charts, process capability, concepts of six sigma, Quality Function Development (QFD), Taguchi quality loss function; TPM- concepts, improvement needs, performance measures.

Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation,; Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors.

Course Outcomes:

Upon completion of this course, the students will be able to use the tools and techniques of TQM in manufacturing and service sectors.

Text Books:

1. Besterfield D.H. et al., Total quality Management, 3rd ed., Pearson Education Asia, 2006.
2. Evans J.R. and Lindsay W.M., The management and Control of Quality, 8th ed., first Indian edition, Cengage Learning, 2012.
3. Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India, 2006.
4. Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India, 2006.

PEC-MAE405: DESIGN AND OPTIMIZATION (Elective – III)

B.Tech (Mechanical & Automation Engineering) VII Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Operation Research

Successive: None

Course Objectives:

The main objective of this course is to introduce the optimisation of design techniques.

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

CO 1- Introduction to design optimization

CO 2- Illustration of different approaches for optimization.

CO 3- Understand about the application optimization in mechanical design.

CO 4- Learning of different optimization techniques.

CO 5- Knowledge of different practical applications of optimization with respect to functionality, aesthetics, economics & materials.

Syllabus:

UNIT I Introduction to Optimum design: Introduction to detail design optimization by simulation, prototyping and optimum. Selection of configuration, materials and processes.

UNIT II Optimization Approach: Classical mathematical methods of optimization. Mechanical System Design problem-economic political environment, issues of human safety & welfare, and professional ethics. Optimum mechanical design concepts.

UNIT III Overview and application of optimization methods to machine elements and mechanical system design. Prototyping, simulation, and use of standards for detail design optimization.

UNIT IV Optimization Techniques: Optimum selection of material & processes in mechanical design using material selection charts and optimization methods.

UNIT V Applications: Optimizing product design functionality, aesthetics and economics by employing industrial design principles and by suitable selection of material & processing including use of polymers, composites and other non-metallic materials.

Text/Reference Books:

1. H. Adeli. Advances in Design Optimization.
2. Robert F. RHYDER, Manufacturing Process Design and Optimization, New York: Marcel Dekker,
3. S.S.Rao, Optimization: Theory & Application Wiley Eastern
4. K. Deb, Optimization for Engineering Design, Prentice Hall India
5. J.S.Arora, Introduction to Optimum Design, McGraw Hill

PEC-MAE407 ENERGY CONSERVATION AND MANAGEMENT (Elective – III)

B.Tech (Mechanical & Automation Engineering) VII Semester

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

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

Pre- Requisite: Applied Thermodynamics

Successive: Nil

Course Objectives:

To understand the energy data from industries and carry out energy audit for energy savings.

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

CO 1- Understand energy & power scenario of world.

CO 2- Gain a knowledge of , how components of EB billing, HT and LT supply.

CO 3- Understand the basics of thermal systems.

CO 4- Analyze the thermal systems and its different components.

CO 5- Understanding Energy Economics.

Course Contents:

Unit 1:

Introduction to energy & power scenario of world, National Energy consumption data, environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing.

Unit 2:

Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.

Unit 3:

Thermal systems, Boilers, Furnaces and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories.

Unit 4:

Thermal systems, Boilers, Furnaces; pumps, fans, blowers, compressed air systems, Refrigeration & Air Conditioning systems, Cooling Towers, DG sets.

Unit 5:

Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.

Text Books:

1. Witte L.C. , Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization,

Hemisphere Publ., Washington, 1988..

2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.

3. Murphy W.R. and McKay G., Energy Management, Butterworths, London, 1987.

4. Energy Manager Training Manual , Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI, 2004 (available at www.energymanager training.com).

PEC-MAE409 MARKETING MANAGEMENT (Elective – III)

B.Tech (Mechanical & Automation Engineering) VII Semester

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

Course Outcomes:

CO1: Understand the role of Marketing Management in industries

CO2: Understand role of Marketing strategies and planning.

CO3: Develop new product.

CO4: Understand the role of forecasting.

CO5: Understand control of Budgeting

UNIT 1. Introduction to Marketing function: genesis, 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. Sociocultural environment. Legal Environment. Ethical issues in marketing.

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.

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.

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, VS and Namakumari, S. Marketing Management: Planning, Control, New Delhi, MacMillan, 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.

PEC-MAE411: INDUSTRIAL ENGINEERING (Elective – III)

B.Tech (Mechanical & Automation Engineering) VII Semester

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

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

Pre- Requisite: Manufacturing Process

Successive: Advanced Manufacturing Processes

Course Objectives:

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

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

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

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

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

CO 4- Apply sales forecasting and materials management techniques.

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

Content:

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

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

UNIT III Work Study: Definition, Objectives, Method study, Principle of motion economy, Techniques of method study – Various charts, THERBLIGS, Work measurement -

various methods, Time Study - PMTS, determining time, Work sampling. Numerical Problems.

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

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

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

Text Books:

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

Reference Books:

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

Web Links:

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

PEC-MAE421 FLEXIBLE MANUFACTURING SYSTEMS (Elective – IV)

B. Tech (Mechanical & Automation Engineering) VII Semester

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

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

Pre- Requisite: Industrial Engineering, Manufacturing Technology and Automation

Successive: None

Course Objectives:

To understand the design, planning and operational concepts of FMS and learn about the different tools and techniques for analyzing the same.

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

- CO 1-** Understand FMS and job-shop and mass production manufacturing systems.
- CO 2-** Knowledge of concept and design of flexible manufacturing cells.
- CO 3-** Explore processing stations and material handling systems used in FMS environments.
- CO 4-** Analyze the production management problems in planning, loading, scheduling, tool management and breakdown in a typical FMS.
- CO 5-** Design and analyze FMS using analytical techniques.

Syllabus:

UNIT I Understanding of FMS: Evolution and classifications of Manufacturing Systems, Definition, Objective and Need, Components, Merits, Demerits and Applications of FMS.

UNIT II Flexible Manufacturing Cell: Part families, parts classification and coding, types of classification and coding systems. Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement.

UNIT III FMS Processing Stations: Machining Centers, Turning centers, CMM, Washing/ Deburring station, etc. Different Layouts and their Salient features.

UNIT IV Material Handling Systems: An introduction, Conveyor, AGV, ASRS, Robots, etc. and their salient features.

UNIT V Management Technology: Tool Management, Configuration planning and routing, Production Planning and Control, Scheduling and control, Computer Networks and Control.

UNIT VI Design of FMS: Performance Evaluation, Analytical models of FMS, Case studies: Typical FMS problems from researches papers.

Text Books:

1. Groover, M.P. "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009

Reference Books:

1. Tempelmeier, H. and Kuhn, H. "Flexible Manufacturing system: Decision support for design and operation", John Wiley and Sons 2003.

2. Maleki A. "Flexible Manufacturing Systems: the technology and management". Prentice Hall International –2009

PEC-MAE423 PROJECT MANAGEMENT (ELECTIVE – IV)

B.Tech (Mechanical & Automation Engineering) VII Semester

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

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

Course Objectives:

To develop project within time, resource & budget, types of projects, project life cycle and decisions. To align project execution with strategies. To identify project issues clearly and come up with new solutions.

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

CO 1- Illustrate the types of projects and project appraisal & selection.

CO 2- Describe and develop project network.

CO 3- Knowledge of the role of human factors in a project.

CO 4- Develop and solve Project evaluation & review technique (PERT) & Critical path method (CPM).

CO 5-Analyze how to control & monitor a project.

Syllabus:

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

UNIT II Go/ No go decisions based on: a) Project Identification and Screening, b) Project Appraisal: Market, Technical, social, Ecological & Financial, c) Project Selection: Pragmatic, pair wise, MADM approach.

UNIT III Development of Project Network: Project description, Work break down structure, Nomenclature, Rules for drawing and representation, consistency and Redundancy in Project Networks, Matrix representation, Basic Scheduling with Networks (Forward & Backward Pass)

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

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

UNIT VI Role of Human Factors and Project completion: Dealing with people Team Building and Leadership in Projects, commitment, work culture, motivation, coordination, attitude, innovation. Project Completion, Review and Future Directions

Text Books:

1. Project Management: A Life Cycle Approach by Arun Kanda. (PHI Learning)
2. Project Management: Engineering, Technology, and Implementation by Shtub, Bard and Globerson,, PH Inc.

Reference Books:

1. Project Management by Clifford Gray and Erik Larson. (Tata McGraw Hill Edition)
2. Management Guide to PERT/ CPM by Wiest, JD and Levy F.K. (PHI)
3. Industrial Engg. & Mgmt. by Dr Ravi Shankar.Galgotia Publications.

Web Links:

1. https://en.wikipedia.org/wiki/Project_management
2. <http://freevideolectures.com/Course/2371/Project-and-Production-Management/2>
3. https://www.youtube.com/watch?v=DdDzybQ_9vM

PEC-MAE425 Computer Integrated Manufacturing(Elective –IV)

B. Tech (Mechanical& Automation Engineering) VII Semester

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

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

Course Objectives:

Study the basic concepts of computer integrated manufacturing, NC,CNC and DNC system. Illustrate the numerical control and part programming. Study the concept of computer aided quality control and material handling.

Course Outcomes:

At the end of the course the students should be able to:

1. Apply robotic control and sensors for quality improvement.
2. Understand the role of CAD/CAM in improving product life cycle.
3. Understand different concepts of FMS.
4. Prepare and analyse numerical control programming.
5. Understand computer aided testing to various equipments.

Syllabus Contents:

Unit 1:

Introduction to CIM. Applications of computers in CIM. Numerical Control: basic components of NC system, NC motion control, system, applications of NC, advantages and disadvantages of NC.

Unit 2:

Conventional Numerical Control: Problems with conventional NC, NC controller technology, computer Numerical control, advantages of CNC, functions of CNC, Direct Numerical Control, components of a DNC system, functions of DNC, advantages of DNC.

Unit 3:

NC part programming: introduction, punched tapes in NC, tape coding and format, NC words, manual part programming, computer assisted part programming, APT language.

Unit 4:

Industrial robots and their applications for transformational and handling activities. Configuration and motions. Actuators, sensors and end effectors. Features like work envelope, precision of movements, weight carrying capacity. Introduction to intelligent robots.

Unit 5:

FMS and CQAC: Introduction, components of a FMS, types of systems, where to apply FMS technology, FMS workstation, planning the FMS. Computer aided quality control: Introduction, the computer in QC, contact and non-contact Inspection methods- optical and non-optical, computer aided testing. Coordinate measuring machine (CMM)

Unit 6:

Computer Integrated Manufacturing systems: Introduction, Technologies used in CIM, Difference between CIM and FMS, CIM hierarchy system, Implementation process of CIM, applications and benefits of CIM.

Reference Books:

1. CNC Technology and Programming—Tilak Raj
2. Automation, Production systems and Computer Integrated Manufacturing :- Groover M. P. (PHI)
3. CAD/CAM : - Zimmers and Groover (PHI)
4. Approach to computer integrated design and manufacturing :- Nanua Singh (John Wiley and sons)

PEC-MAE427 NON CONVENTIONAL ENERGY RESOURCES UTILIZATION

(ELECTIVE – IV)

B.Tech (Mechanical & Automation Engineering) VII Semester

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory : 75 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

Pre- Requisite: Thermodynamics

Successive: None

Course Objectives:

To study energy resources, energy planning and their utilization. To study various non-conventional energy sources such as bio-gas, solar energy and its utilization, wind energy, etc. To study operating characteristics of fuel cells and tidal energy.

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

CO 1- Understand about the types of energy resources and energy requirement.

CO 2- Complete understanding about production and utility of bio-gas and wind energy.

CO 3- Knowledge of the utility of solar energy.

CO 4- Familiarization of the project evaluation & review technique (PERT) & critical path method (CPM).

CO 5- Understanding tidal and wave energy as alternate resource.

Syllabus:

UNIT I Energy Resources and their Utilization : Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

Solar Radiations: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour

angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.

UNIT II Solar Energy: Solar thermal power and its conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, Solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, Solar pumping, Solar cooking, Greenhouses, Solar power plants.

Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

UNIT III Biogas: Photosynthesis, Bio gas production, Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.

UNIT IV Wind Energy: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development.

UNIT V Tidal Power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy, Limitations of tidal energy conversion systems.
Hydrogen Energy: Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.

UNIT VI Thermoelectric Systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. Geothermal energy: Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion.

Ocean Energy: Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC,

Reference Books:

1. Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata McGraw Hill.
2. Kothari D.P., "Renewable energy resources and emerging technologies", Prentice Hall of India Pvt. Ltd.
3. Ashok V. Desai, "Non conventional Energy", New Age International Publishers Ltd.

PEC-MAE429: SYSTEM MODELING & SIMULATION (ELECTIVE – IV)

B.Tech (Mechanical & Automation Engineering) VII Semester

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

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

Pre- Requisite: Control System

Successive: None

Course Objectives:

To introduce the students about the knowledge of basic and dynamic system models of engineering and simulation system.

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

- CO 1-** understand the system concept and apply functional modeling method to model the activities of a static system;
- CO 2-** understand the behavior of a dynamic system and create an analogous model for a dynamic system.
- CO 3-** simulate the operation of a dynamic system and make improvement according to the simulation results
- CO 4-** Characterise a given engineering system in terms of its essential elements, that is, purpose, parameters, constraints, performance requirements, subsystems, interconnections and environmental context.
- CO 5-** Interpret the simulation results of an engineering system model, within the context of its capabilities and limitations, to address critical issues in an engineering project.

Syllabus:

UNIT - I

Basic System models: Mathematical models, Mechanical system building blocks, Electrical system building block, fluid system building block, thermal system building block.

System Models: Engineering systems, Rotational translational systems, Electro-mechanical systems, linearity, Hydraulic Mechanical systems.

UNIT II

Dynamic Response of Systems:

Modelling dynamic systems, Terminology, First order systems, Second order systems, performance measure of second order systems, system identification.

UNIT III

System Transfer Functions:

The transfer function, first order systems, second order systems, systems in series, systems with feedback loops, effect of pole location on transient response.

UNIT – IV

Mechanical Event Simulation (Finite Element modelling and Analysis):

Introduction, General procedure of finite element method, finite element analysis, iso-parametric evaluation of element matrices, finite element modelling, mesh generation, design and engineering applications. Introduction to Pro E software - Mechanica& dynamic simulation module.

UNIT – V

System Simulation:

Introduction, Review of probability and statistics, Managing the event calendar in a discrete event simulation model, Modelling input data.

UNIT – VI

Generation of random numbers and variates, generic features and introduction to Arena Software, Real world applications of simulation, Discrete continuous simulation, verification and validation of simulation models.

Text Book:

- [1] W. Bolton, “Mechatronics – Electronic control systems in Mechanical & Electrical Engineering”, Pearson Education Ltd.
- [2] Ibrahim Zeid, “CAD/CAM Theory and Practice”, Tata McGraw-Hill Publishing Company Limited.
- [3] SankarSengupta, System Simulation and modelling, Pearson.

Reference Books:

- [1] Deo, Narsingh, Millican Charles E.,”System Simulation With Digital Computer”, PHI.
- [2] Gordon, Geoffrey, System Simulation, PHI.
- [3] P. Radhakrishnan, S Subramanyan, V. Raju, CAD/CAM/CIM, New Age International Publishers.

PEC-MAE431 PRODUCT DESIGN AND DEVELOPMENT (Elective – IV)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

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

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.

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

1. Understand the methods of product development.
2. To understand the product concept generation and specifications.
3. To understand the methods of industrial product design and prototyping.
4. To understand the concept of design for manufacture.

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

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

PEC-MAE441 AUTOMOBILE ENGINEERING (Elective – V)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

Pre- Requisite: Thermodynamics, Dynamics of Machines, I. C. Engines

Successive: Project

Course Objectives:

To understand the construction and working principle of various parts of an automobile

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

- CO 1-** Understand the principle of automobiles drive and advances in automobiles.
- CO 2-** Explore the concept of various types of clutch.
- CO 3-** Learn about various types of steering system along with merits and demerits.
- CO 4-** Knowledge of the various types of hybrid vehicles.
- CO 5-** Development and understanding of hydrogen based technology for pollution control.

Course Contents:

Unit1;

Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicle aerodynamics, IC engines- components, function and materials, variable valve timing (VVT). Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

Unit2:

Transmission systems, clutch types & construction, gear boxes- manual and automatic gear shift mechanisms, Over drive, transfer box, flywheel, torque converter, propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

Unit3

Steering geometry and types of steering gear box, power steering, types of front axle, types of suspension systems, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control.

Unit 4:

Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells

.Text books:

1. Kirpal Singh, Automobile Engineering, 7th ed., Standard Publishers, New Delhi, 1997.

2. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
3. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999.
4. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

PEC-MAE443 NUMERIC CONTROL OF MACHINE TOOLS AND ROBOTICS

(Elective – V)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

Course Objectives:

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

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

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

Syllabus:

UNIT 1.Numeric Control: Introduction to numerical control components axes of NC machine tools, open and close loop control, actuation and feedback systems, Point to point, lined and contouring systems, Tooling for NC systems, Steps in NC manufacturing, Machining and turning centers and their features, ATC and APC.

UNIT 2.NC programming: Input media and coding formats. Manual part programming for lathe, drilling and milling machines, cutter diameter and length compensation, Computer assisted part programming languages APT, EXPAT, ADAPT, COMPACT, CAD/CAM approach of programming.

UNIT 3.Computer numerical control: Direct numerical control and distributed numerical control, adaptive control.

UNIT 4.Robotics: Industrial robots and their applications for transformational and handling activities, Configuration and motions, Actuators, sensors and end effectors, Features like work envelop, precision of movements, weight carrying capacity, Robot programming languages, Vision systems, Introduction to intelligent robots.

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

PEC-MAE445 APPLIED HYDRAULICS AND PNEUMATICS (Elective – V)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

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

Pre- Requisite: Mechatronics

Successive: none

Course Objectives:

This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

Course Outcomes (COs):

CO 1 Understanding operating principles and constructional features of hydraulic and pneumatic systems.

CO 2 Knowledge with selection of hydraulic / pneumatic components

CO 3 understanding of designing and layout of Hydraulic Power package and trouble shooting

CO 4- Understanding construction and working principle of hydraulic valves

CO 5- Understanding construction and working principle of pneumatic valves

Content:

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work, Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps-Problems

UNIT II HYDRAULIC ACTUATORS Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning - Hydraulic motors Control Components: Direction control, Flow control

UNIT III HYDRAULIC VALVES Pressure control valves- Types, Construction and Operation- Servo and Proportional valves - Applications – Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols – Problems

UNIT IV HYDRAULIC SYSTEMS Accumulators, Intensifiers, Industrial hydraulic circuits- Regenerative, Pump Unloading, Double- pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-safe, 53 Speed control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNIT V PNEUMATIC SYSTEMS Properties of air– Perfect Gas Laws- Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Design of pneumatic circuit cascade method- Electro pneumatic circuits, Introduction to Fluidics, Pneumatic logic circuits.

UNIT VI TROUBLE SHOOTING AND APPLICATIONS Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling in a CNC machine. - Low cost Automation – Hydraulic and Pneumatic power packs- case studies

TEXT BOOK:

1. Anthony Esposito, “Fluid Power with Applications”, Prentice Hall, 2009.

REFERENCES:

1. Shanmugasundaram.K, “Hydraulic and Pneumatic Controls”, Chand & Co, 2006.
2. Majumdar, S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata Mc Graw Hill, 2001
3. Majumdar, S.R., “Pneumatic Systems – Principles and Maintenance”, Tata Mc Graw Hill, 2007.
4. Dudleyt, A Pease and John J Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
5. Srinivasan.R, “Hydraulic and Pneumatic Controls”, Vijay Nicole Imprints, 2008.
6. Joji.P, “Pneumatic Controls”, John Wiley & Sons India, 2008

PEC-MAE447 MICROPROCESSORS IN AUTOMATION(Elective – V)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

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

Objectives:

To introduce the basic concepts of Digital circuits, Microprocessor system and digital controller

Course Contents: Number Systems, codes, digital electronics: Logic Gates, combinational

circuits design, Flip-flops, Sequential logic circuits design: Counters, Shift registers. Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals.

Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller; Interfacing peripherals:

Programmable peripheral interface (8255).

Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features,

Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z-Transform, Digital Filters, Implementation of Digital Algorithm.

Course Outcomes:

Students who have done this course will have a good idea of the use of microprocessors for automation.

Text Books:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.

4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition,2007).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall

PEC-MAE449 MECHANICAL VIBRATIONS (Elective – V)

B. Tech (MECHANICAL & AUTOMATION ENGINEERING) VII Semester

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

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

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.

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

1. Understand the fundamentals of mechanical vibrations leading to analysis of first degree of freedom.
2. To understand the concept of two degree of vibration and vibration isolation and transmissibility.
3. To analyse the normal modes in case of multi degree of freedom systems using numerical methods.
4. Understanding the influence and stiffness coefficients
5. Understanding the transient vibrations

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.

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, 3rdEd, 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.

PCC-MAE 451 : AUTOMATION IN MANUFACTURING

B. Tech. VII Semester

No. of Credits: 3

L T P Total

3 00 3

Duration of Exam: 3 Hours

Sessional: 25 Marks

Theory : 75 Marks

Total: 100 Marks

Objectives:

1. To understand the importance of automation in the of field machine tool based manufacturing
2. To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC
3. To understand the basics of product design and the role of manufacturing automation

Course Outcomes:

Upon completion of this course, the students will get a comprehensive picture of computer based automation of manufacturing operations

Course Contents:

Introduction: Why automation, Current trends, CAD, CAM, CIM; Rigid automation: Part handling, Machine tools. Flexible automation: Computer control of Machine Tools and Machining Centers, NC and NC part programming, CNC-Adaptive Control, Automated Material handling. Assembly, Flexible fixturing.

Computer Aided Design: Fundamentals of CAD - Hardware in CAD-Computer Graphics Software and Data Base, Geometric modeling for downstream applications and analysis methods; Computer Aided Manufacturing: CNC technology, PLC, Micro-controllers, CNC-Adaptive Control

Low cost automation: Mechanical & Electro mechanical Systems, Pneumatics and Hydraulics, Illustrative Examples and case studies

Introduction to Modeling and Simulation: Product design, process route modeling, Optimization techniques, Case studies & industrial applications.

Text Books:

1. MikellP. Groover, Automation, Production Systems, and Computer-integrated Manufacturing, prentice Hall
2. SeropeKalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology, 7th edition,Pearson
3. YoramKoren, Computer control of manufacturing system, 1st edition
4. Ibrahim Zeid , CAD/CAM : Theory & Practice, 2nd edition.

The Syllabus for Open Elective Courses offered by CE and IT Department:

OEL-CE-201 INTELLIGENT SYSTEMS

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

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

UNIT I Fundamental Issues in IS : Definition of AI , History ,Domains AI ,AI problems & State space ,Some examples problems representations like Travelling Salespersons, Syntax analysis Problem. Basic issues to solve AI problems, Underlying assumptions, AI techniques, Level of model ,Criteria for success , Control strategies, DFS, BFS

UNIT II Heuristic Search Techniques: Generate & Test, Hill Climbing (simple &stipest), Best first search, A*, AO*, Constraint Satisfaction.

UNIT III Knowledge Representation Issues: Syntax & Semantic for Propositional logic, Syntax & Semantic for FOPL, Properties for WFF's, Resolution Basics : conversion to clausal form ,Resolution of proposition logic, Resolution algorithms for predicates, Problems with FOPL ,Semantic nets ,Frames ,Scripts

UNIT IV Reasoning Under Uncertainty: An introduction, Default reasoning & Closed world assumptions, Model & Temporal logic ,Fuzzy logic, Basian Probabilistic inference Dempster Shafer theory ,Heuristic reasoning methods

UNIT V Planning & Learning : Planning, Planning in Situational calculus ,Representation for planning ,Partial order palnning, Partial order palnning algorithm, Learning by Examples, Learning by Analogy, Explanation based learning, Neurals nets, Genetics algorithms

UNIT VIMinimax: 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 Nils J. Nilsson, Pearson Education Pub.
3. Artificial Intelligence by DAN. W. Petterson. Printice Hall of India
4. Artificial Intelligence by Petrick Henry Winston,
5. Artificial Intelligence by Russel and Norvig, Pearson Education Pub.

GC 102C CYBER LAWS AND SECURITY

No. of Credits: 3

L T P Total

3 0 0 3 Total :

100 Marks

Sessional: 25 Marks

Theory: 75 Marks

Duration of Exam: 3 Hours

UNIT I History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.

UNIT II Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges

UNIT III Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

UNIT IV Security metrics- Classification and their benefits Information Security & Law, IPR, Patent Law, Copyright Law, Legal Issues in Data Mining Security, Building Security into Software Life Cycle Ethics- Ethical Issues, Issues in Data and Software Privacy Cyber Crime Types & overview of Cyber Crimes

References:

1. Godbole, "Information Systems Security", Wiley
2. Merkov, Breithaupt, "Information Security", Pearson Education
3. Yadav, "Foundations of Information Technology", New Age, Delhi
4. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill
5. Sood, "Cyber Laws Simplified", Mc Graw Hill
6. Furnell, "Computer Insecurity", Springer 7. IT Act 2000

GC- 103C SOFT COMPUTING

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

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

UNIT I Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms- Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms- perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perception Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

UNIT II Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

UNIT III Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

UNIT IV Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT V Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Genetic Algorithms, Scope & application areas, solution of 0-1 Knapsack problem using GA

References:

1. "Fuzzy sets and Fuzzy Logic: Theory and applications", G.J. Klir, B. Yuan, PHI
2. "Introduction to Fuzzy sets and Fuzzy Logic", M. Ganesh, PHI
3. "An Introduction to Fuzzy Control", D. Driankov, H. Hellendoorn, M. Reinfrank, Narosa Publishing Company
4. "Neural Networks: A classroom approach", Satish Kumar, Tata McGraw Hill
5. Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.

GC-104C WEB TECHNOLOGY AND INFORMATION RETRIEVAL

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

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

UNIT I Web Server Technology: Web's Robot global access to information, HTML, HTTP, Accessing a web server, publishing on web server, secure HTTP, Secure Sockets Layer, WWW Proxies, IIS, Case study of apache web server.

UNIT II Web Search Basics: Background and history, Anatomy of WWW, Web characteristics, Spam, The web graph, The Web Search Users, search engines, architecture of search engines, search tools, DNS resolution, The URL frontier, Link analysis, Page Rank.

UNIT III Web Crawlers: Basics of Web crawling, Various crawling techniques, incremental crawler, parallel crawler, distributed crawlers, focused crawler, agent based crawler, Hidden web Crawler

UNIT IV Introduction to Information Retrieval: Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

UNIT V Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes
Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression.

GC-105C INTELLECTUAL PROPERTY RIGHTS

No. of Credits: 3

L T P Total

3 0 0 3

Sessional: 25 Marks

Theory: 75 Marks

Total : 100 Marks

Duration of Exam: 3 Hours

UNIT I Introduction to Intellectual Property: Concept of Intellectual Property, Kinds of Intellectual Property, Economic Importance of Intellectual Property, **Indian Theory on Private Property:** Constitutional Aspects of Property, Constitutional Protection of Property and Intellectual Property, **Economic Development and Intellectual Property Rights Protection**

UNIT II Introduction to Patents: Overview, Historical Development, Concepts: Novelty, Utility, **Patentable Subject-matter:** Patent Act, 1970- Amendments of 1999, 2000, 2002 and 2005, Pharmaceutical Products and Process and Patent, Protection, Software Patents, Business Method, Protection of Plant Varieties and Farmers' Rights Act, 2001, Patenting of Micro-organism

UNIT III Procedure of Obtaining of Patents: Concepts of a Patent Application,, Specification: Provisional, Complete, Disclosure Aspects, Claims: Principal, Dependant, Omnibus, Examination of Application, Opposition of Application, Sealing of Patents

UNIT IV Working of Patents – Compulsory License: Commercialization of Inventions: License- Terms of License Agreement, Assignments of Patents, Revocation of Patents

UNIT V Infringement: What is Infringement?, How is Infringement determined? Who is an Infringer? Direct, Contributory and Induced, Defences of Infringement:

5.2.1 Research Exemption, Invalidity, Misuse, Failure to mark, Laches and Estoppel and first sale doctrine

References:

1. W.R. Cornish, Intellectual Property, Sweet & Maxwell, London (2000)
2. P. Narayana, Patent Law, Wadhwa Publication
3. Merges, Patent Law and Policy: Cases and Materials, 1996
4. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993

5. Brinkhof (Edited), Patent Cases, Wolters Kluwer.
6. Prof. Willem Hoyng & Frank Eijsvogels, Global Patent Litigation, Strategy and Practice, Wolters Kluwer.
7. Gregory Stobbs, Software Patents Worldwide, Wolters Kluwer.
8. Feroz Ali Khader, The Law of Patents- With a special focus on Pharmaceuticals in India, Lexis Nexis Butterworths Wadhwa, Nagpur.
9. Sookman, Computer Law, 1996
10. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009). Eastern Book Company, Lucknow.