SCHEME and SYLLABUS

for

BACHELOR OF TECHNOLOGY

in

MECHANICAL ENGINEERING

(w.e.f. session 2023-2024)

(Choice Based Credit Scheme)

DEPARTMENT OF MECHANICAL ENGINEERING

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

The scheme and Syllabus approved in 21st BOS (UG) held on 24.03.2023; Item No. BOS/21/03

J.C. Bose University of Science & Technology, YMCA, Faridabad
(A Haryana State Government University)
(Established by Haryana State Legislative Act No. 21 of 2009 & Recognized by UGC Act 1956 u/s 22 to Confer Degrees)
Accredited 'A' Grade by NAAC

Ref. No. _____ Dated: 25.05.2023

CERTIFICATE

This is to certify that the scheme & syllabi of B.Tech (Mechanical Engg) (course name & scheme) is duly approved by the competent body/authority and to the best of my knowledge the contents of the same, are correct in all respect.

This Scheme & Syllabus has been approved in 21st Meeting (meeting no.) of BOS held on dated 24.03.2023; Item No.- BOS/21/03

Chairman
Department of Mechanical Engineering
J C Bose University of Science and Tech., YMCA
Sector-25, Faridabad-121006
25/05/23

Date: 25.05.2023

Signature & Stamp of Chairperson

Name: Prof. Arvind Gupta

Deptt. Name Mechanical Engg

25.05.2023
(Dr Sandhya Dixit)
Academic Coordinator, ME

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.

ABOUT THE PROGRAMME

J C Bose University of Science & Technology, YMCA, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, was established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCAs of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized fields of engineering to meet specific technical manpower requirements of industries. Mechanical Engineering Department was started in 1969 and has been conducting 4 years B.Tech Course in Mechanical Engineering since 1997 with an intake of '60' students and subsequently, it was increased to '75' in 1999, '90' in 2004 and '120' in 2007. Students are admitted through centralized counseling conducted by State Government. Presently, the total intake for the B.Tech programme is 120 and 12 through LEET in second year. Besides B.Tech. in Mechanical Engineering, B.Tech. in Robotics and Artificial Intelligence has also been started with an intake of 30 since 2021. The department is also running M.Tech. in Manufacturing Technology and Automation with an intake of 18 and PhD. All courses are duly approved by AICTE/ UGC. Both UG and PG programmes are NBA accredited. The department has started minor degree in 'Robotics' from session 2023-24 onwards. The Mechanical Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has a separate building with ICT enabled class rooms, state of the art laboratories, research lab, workshops, seminar room, conference hall and departmental library. It has established Centre of Excellence with M/s Danfoss India (P) Ltd. in the area of 'Climate and Energy' and one with M/s Daikin (P) Ltd. in the field of 'Refrigeration and Air Conditioning'. It has well qualified and experienced faculty. The syllabi of UG/PG courses in Mechanical Engineering Department have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. One semester Industrial training is mandatory for every B.Tech student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system (CBCS) allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1

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

PEO-2

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

PEO-3

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

PEO- 4

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

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1) **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of engineering problems.

2) **Problem Analysis:** Identify, formulate, review literature and analyze mechanical engineering problems to design, conduct experiments, analyze data and interpret data.

3) **Design /Development of Solutions:** Design solution for mechanical engineering problems and design system component of processes that meet the desired needs with appropriate consideration for the public health and safety, and the cultural, societal and the environmental considerations.

4) **Conduct Investigations of Complex Problems**: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in mechanical engineering.

5) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to mechanical engineering activities with an understanding of the limitations.

6) **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to mechanical engineering practice.

7) **Environment and Sustainability:** Understand the impact of the mechanical engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the mechanical engineering practice.

9) **Individual and Team Work:** Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in mechanical engineering.

10) **Communication:** Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as, being able to comprehend and write affective reports and design documentation, make effective presentations in mechanical engineering.

11) **Project Management and Finance:** Demonstrate knowledge & understanding of the mechanical engineering principles and management principles and apply these to one's own work, as a

member and leader in a team, to manage projects and in multidisciplinary environments in mechanical engineering.

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

PROGRAM SPECIFIC OUTCOMES (PSOs):

1) Ability to assimilate the practical knowledge and Mechanical Engineering skills in profession.

2) Ability to innovate in specific aspects of Mechanical Engineering maintaining high standard of social well being and ethical values.

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

SCHEME OF STUDIES & EXAMINATIONS

FOUR YEARS BACHELOR OF TECHNOLOGY PROGRAMME IN

MECHANICAL ENGINEERING

SEMESTER I – VIII (w. e. f. Session 2023-24)

B. TECH SCHEME CREDITS CALCULATIONS

S. No.	Category of Courses	Contact Hours	Credits
1.	Programme Core Courses (PCC)	75	67
2.	Basic Science Courses (BSC)	37	34
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)	32	26
8.	Mandatory Audit Courses (MAC)	4	0
9.	Massive Open Online Courses (MOOCS)*	-	-
10.	Value Added Courses (VAC)**	-	-
11.	Induction Program	-	-
	Total	**208**	**177***

Note: * It is mandatory to pass the MOOC course(s) by all the students as per implementation of credit transfer/ mobility policy of online courses of the University-as mentioned in Annexure at the end of the syllabus. (One MOOC is to be completed every Year of minimum 3 credits)

**** Value Added Courses are floated and conducted in the department from time to time for Skill enhancement/ Employability/ Imparting Ethical Values to the Students.**

MANDATORY INDUCTION PROGRAM (3-WEEKS DURATION)

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. A 3-week long induction program for the UG students entering the institution, right at the start, has to be planned. Normal classes will start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

Tentative activities which can be planned in this Induction Programme are as follows:

- Physical Activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to Local Area
- Familiarization to Dept./Branch & Innovations

SEMESTER WISE SUMMARY OF THE PROGRAMME

S.No.	Semester	Contact Hours	Marks	Credits
1.	I	25 per week	650	19.5/ 18.5
2.	II	29 per week	700	21.5/ 22.5
3.	III	33 per week	900	29
4.	IV	33 per week	950	26
5.	V	29 per week	800	23
6.	VI	33 per week	950	26
7.	VII/VIII	26 per week	800	22
8.	VIII/VII	One Semester	500	10
	Total	**208**	**6250**	**177**

PROGRAMME CORE COURSES (PCC)

S. No.	Code	Name of the Course	Contact Hours	Credits	Semester
1.	PCC-ME-301/21	Thermodynamics	4	4	III
2.	PCC-ME-302/21	Strength of Materials-I	4	4	III
3.	PCC-ME-303/21	Fluid Mechanics and Machines	4	4	III
4.	PCC-ME-304/21	Strength of Materials Lab	2	1	III
5.	PCC-ME-305/21	Fluid Mechanics and Machines Lab	2	1	III
6.	PCC-ME-401/21	Applied Thermodynamics	4	4	IV
7.	PCC-ME-402/21	Materials Engineering	3	3	IV
8.	PCC-ME-403/21	Kinematics of Machines	3	3	IV
9.	PCC-ME-404/21	Strength of Materials-II	3	3	IV
10.	PCC-ME-405/21	Manufacturing Processes	3	3	IV
11.	PCC-ME-406/21	Thermal Lab –I	2	1	IV
12.	PCC-ME-407/21	Materials Engineering Lab	2	1	IV
13.	PCC-ME-408/21	Kinematics of Machines Lab	2	1	IV
14.	PCC-ME-501/21	Heat and Mass Transfer	3	3	V
15.	PCC-ME-502/21	Dynamics of Machines	3	3	V
16.	PCC-ME-503/21	Design of Machine Elements- I	4	4	V
17.	PCC-ME-504/21	Refrigeration and Air-conditioning	3	3	V
18.	PCC-ME-505/21	Industrial Engineering	3	3	V
19.	PCC-ME-506/21	Thermal Lab- II	2	1	V
20.	PCC-ME-507/21	Dynamics of Machines Lab	2	1	V
21.	PCC-ME-601/21	CAD/ CAM	3	3	VI
22.	PCC-ME-602/21	Manufacturing Technology	3	3	VI
23.	PCC-ME-603/21	Design of Machine Elements – II	3	3	VI
24.	PCC-ME-604/21	CAD/ CAM Lab	2	1	VI
25.	PCC-ME-701/21	Automation in Manufacturing	3	3	VII/ VIII
26.	PCC-ME-702/21	Operations Research	3	3	VII/ VIII
		Total	**75**	**67**	

BASIC SCIENCE COURSES (BSC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	BSC-103A	Mathematics-I	4	4	I
2.	BSC-102	Chemistry	4	4	I/II
3.	BSC-105	Chemistry Lab	3	1.5	I/II
4.	BSC-101F	Physics	4	4	II/I
5.	BSC-106A	Mathematics- II	4	4	II
6.	BSC-104A	Physics Lab	3	1.5	II/I
7.	MCEVS-01	Environment and Ecology	3	3	II
8.	BSC-201	Mathematics-III	3	3	III
9.	BSC-01	Biology	3	3	III
10.	MCEVS-02	National Resources and Biodiversity Conservation	3	3	IV
11.	MCEVS-03	Environment Pollution, Waste Management and Sanitation	3	3	VI
		Total	**37**	**34**	

ENGINEERING SCIENCE COURSES (ESC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	ESC-101A	Basic Electrical Technology	4	4	I/II
2.	ESC-107A	Basic Electrical Technology Laboratory	2	1	I/II
3.	ESC-104A/21	Workshop- I	4	2	I
4.	ESC-103	Programming for Problem Solving	3	3	II/I

5.	ESC-105	Programming for Problem Solving Lab	4	2	II/I
6.	ESC-102A/21	Engineering Graphics and Drawing	4	2	II/I
7.	ESC-106A/21	Workshop- II	4	2	II
8.	ESC-201	Basics of Electronics Engineering	3	3	III
9.	ESC-203A/21	Engineering Mechanics	4	4	III
		Total	**32**	**23**	

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	HSMC-101	English	2	2	I/II
2.	HSMC-102	English Lab	2	1	I/II
		Total	**4**	**3**	

PROGRAMME ELECTIVE COURSES (PEC)

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

OPEN ELECTIVE COURSES (OEC)

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

SKILL ENHANCEMENT COURSES (SEC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	SEC-WS-301/21	Workshop III	4	2	III
2.	SEC-WS-401/21	Workshop IV	4	2	IV
3.	SEC-WS-501/21	Workshop V	4	2	V
4.	SEC-WS-601/21	Workshop VI	4	2	VI
5.	SEC-WS-701/21	Workshop VII	4	2	VII/ VIII
6.	SEC-401/21	Project I	4	2	IV
7.	SEC-601/21	Project II	4	2	VI
8.	SEC-701/21	Project III	4	2	VII/ VIII
9.	SEC-801/21	Industrial Training	One semester	10	VIII/ VII
		Total	**32**	**26**	

MANDARORY AUDIT COURSES (MC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	MC-02	Essence of Indian Traditional Knowledge	2	0	V
2.	MC-04G	Message of Bhagavad Gita	2	0	VI
		Total	**4**	**0**	

VALUE ADDED COURSES (VAC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	HSMC (H-102)	Universal Human Values 2: Understanding Harmony	3	0	-
2.	VAC01	Human Values and Professional Ethics	3	0	-
		Total	**6**	**0**	

PROGRAMME ELECTIVE COURSE-I (PEC-I) (Semester-VI)

S. No.	Code	Name of Course	Contact Hours	Credits
1	PEC-ME-601/21	Visionary Learning in Manufacturing	3	3
2.	PEC-ME-602/21	Product Design and Development	3	3
3.	PEC-ME-603/21	Internal Combustion Engines	3	3
4.	PEC-ME-604/21	Gas Dynamics and Jet Propulsion	3	3
5.	PEC-ME-605/21	Welding Technology	3	3
6.	PEC-ME-606/21	Mechatronics Systems	3	3

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

PROGRAMME ELECTIVE COURSE-II (PEC-II) (Semester-VI)

S. No.	Code	Name of Course	Contact Hours	Credits
1.	PEC-ME-621/21	Flexible Manufacturing Systems	3	3
2.	PEC-ME-622/21	Reliability, Availability and Maintainability	3	3
3.	PEC-ME-623/21	Principles of Management	3	3

4.	PEC-ME-624/21	Aircraft Technology	3	3
5.	PEC-ME-625/21	Numeric Control of Machine Tools, Robotics and Rapid Prototyping	3	3
6.	PEC-ME-626/21	Industrial Tribology and Lubrication	3	3
7.	PEC-ME-627/21	Electric Vehicle and Transmission System	3	3

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

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

S. No.	Code	Name of Course	Contact Hours	Credits
1.	PEC-ME-701/21	Maintenance Engineering and Management	3	3
2.	PEC-ME-702/21	Total Quality Management	3	3
3.	PEC-ME-703/21	Non-Conventional Energy Resources Utilization	3	3
4.	PEC-ME-704/21	Air Conditioning Equipments	3	3
5.	PEC-ME-705/21	Tool Design	3	3
6.	PEC-ME-706/21	Acoustics and Vibrations	3	3

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

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

S. No.	Code	Name of Course	Contact Hours	Credits
1.	PEC-ME-721/21	New Venture Creation	3	3
2.	PEC-ME-722/21	Project Management	3	3
3.	PEC-ME-723/21	Automobile Engineering	3	3
4.	PEC-ME-724/21	Design of Thermal Systems	3	3
5.	PEC-ME-725/21	Metallurgy	3	3
6	PEC-ME-726/21	Composite Materials	3	3
7.	PEC-ME-727/21	Modeling, Simulation and Optimization	3	3

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

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

S. No.	Code	Name of Course	Contact Hours	Credits
1.	PEC-ME-741/21	Marketing Management	3	3
2.	PEC-ME-742/21	Process Planning and Cost Estimation	3	3
3.	PEC-ME-743/21	Quality Management Systems	3	3
4.	PEC-ME-744/21	Power Plant Engineering	3	3
5.	PEC-ME-745/21	Energy Conservation and Management	3	3
6.	PEC-ME-746/21	Micro and Nano Manufacturing	3	3
7.	PEC-ME-747/21	Finite Element Analysis	3	3

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

OPEN ELECTIVE COURSES- I (OEC- I) (Semester V)

Students have to select any one Open Elective Course-I from the list of courses offered by Computer Engineering Department or the Civil Engineering Department:

Courses offered by Computer Engineering Department

S. No.	Code	Name of Course	Contact Hours	Credits
1.	OEC-ME-501	Intelligent Systems	3	3
2.	OEC-ME-502	Cyber laws and Security	3	3
3.	OEC-ME-503	Soft Computing	3	3
4.	OEC-ME-504	Web Technology and Information Retrieval	3	3
5.	OEC-ME-505	Intellectual Property and Rights	3	3

Courses offered by Civil Engineering Department

S. No.	Code	Name of Course	Contact Hours	Credits
1.	OEC-ME-506	Basic Environmental Engineering	3	3
2.	OEC-ME-507	Traffic Engineering and Management	3	3
3.	OEC-ME-508	Contracts Management	3	3
4.	OEC-ME-509	Solid and Hazardous Waste Management	3	3
5.	OEC-ME-510	Air and Noise Pollution and Control	3	3

OPEN ELECTIVE COURSES- II (OEC- II) (Semester VI)

Students have to select any one Open Elective Course-II from the list of courses offered by Electrical Engineering Department or the Electronics Engineering Department:

Courses offered by Electrical Engineering Department

S. No.	Code	Name of Course	Contact Hours	Credits
1.	ELPE411	Electrical Energy Conservation and Auditing	3	3
2.	ELPE412	Industrial Electrical System	3	3
3.	ELPC 502	Control System	3	3
4.	ELPE614	Wind and Solar Energy System	3	3
5.	ELPE612	Electrical and Hybrid Vehicles	3	3

Courses offered by Electronics Engineering Department

S. No.	Code	Name of Course	Contact Hours	Credits
1.	OEC-ME-606	Microprocessor and Interfacing	3	3
2.	OEC-ME-608	Digital Signal Processing	3	3
3.	OEC-ME-610	Instrumentation and Control	3	3
4.	OEC-ME-612	Data Communication and Networking	3	3

OPEN ELECTIVE COURSES- III (OEC- III) (Semester VII/ VIII)

Students have to select any one Open Elective Courses-III from the list of courses offered by Humanities Department or the Management Department:

Courses offered by HAS Department

S. No.	Code	Name of Course	Contact Hours	Credits
1.	OEC-ME-442	Soft Skills for Engineers	3	3
2.	OPHL-306A	Physics and Our World	3	3
3.	OPHL-305A	Introduction to Astrophysics and Cosmology	3	3
4.	OES-301A	Waste Management in our Daily Life	3	3
5.	OES-302A	Environmental Conservation	3	3

Courses offered by MBA Department

S. No.	Code	Name of Course	Contact Hours	Credits
1.	OEC-ME-444	Human Resource Management	3	3
2.	OEC-ME-446	Finance and Accounting	3	3
3.	OEC-ME-450	Entrepreneur Development	3	3
4.	OEC-ME-452	Economics for Engineers	3	3

GRADING SCHEME

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

Percentage calculation= CGPA * 9.5

Cumulative Grade Point Average (CGPA)

A student is required to maintain a Cumulative Grade Point Average (CGPA) which is the weighted average of all the Letter Grades obtained by the student since his/ her entry into the University upto and including the latest semester and is computed as follows:

$$CGPA= \sum(C_i G_{i)} / C_i$$

Where, C_i denotes the credits assigned to i^{th} course and G_i indicates the Grade Point Equivalent to the Letter Grade obtained by the student to the i^{th} course. Provided that when a student re-appears in/ repeats a course, the new Grade will replace the earlier one in the calculation of the CGPA.

Note:

At the end of the semester (i.e. after End Semester Examination), students will be supplied a DMC indicating the grades secured in each course, Semester Grade Point Average (SGPA) and up-to-date CGPA.

B.TECH MECHANICAL ENGINEERING

(I-VIII SEMESTER)

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1st YEAR (SEMESTER – I) MECHANICAL ENGINEERING (2023-24)

Course Notation	Course Code	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examinations		Total Marks	Credits	Course Type
			L	T	P	Total		Theory	Practical			
B	BSC-101F	Physics (Introduction to Electromagnetic Theory)	3	1	-	4	25	75	-	100	4	BSC
C	BSC-103A	Mathematics-I (Calculus and Linear Algebra)	3	1	-	4	25	75	-	100	4	BSC
A	ESC-101A	Basic Electrical Technology	3	1	-	4	25	75	-	100	4	ESC
B	ESC-102A/21	Engineering Graphics and Drawing	-	-	4	4	30	-	70	100	2	ESC
A	BSC-102	Chemistry	3	1	-	4	25	75	-	100	4	BSC
B	ESC-103	Programming for Problem Solving	3	-	-	3	25	75	-	100	3	ESC
C	ESC-104A/21	Workshop-I	-	-	4	4	30	-	70	100	2	ESC
A	HSMC-101	English	2	-	-	2	25	75	-	100	2	HSMC
B	BSC-104A	Physics Electromagnetic Lab	-	-	3	3	15	-	35	50	1.5	BSC
A	ESC-107A	Basic Electrical Technology Laboratory	-	-	2	2	15	-	35	50	1	ESC
A	BSC-105	Chemistry Laboratory	-	-	3	3	15	-	35	50	1.5	BSC
B	ESC-105	Programming for Problem Solving lab	-	-	4	4	15	-	35	50	2	ESC
A	HSMC-102	English Lab	-	-	2	2	15	-	35	50	1	HSMC

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

Important Notes:

Significance of the Course Notations used in this scheme: -

C = These courses are common to both the groups Group-A and Group-B.

A = Other compulsory courses for Group-A.

B = Other compulsory courses for Group-B.

Students will study either

Group A (BSC103A, ESC101A, BSC102, ESC104A/21, HSMC101, ESC107A, BSC105, HSMC102)

OR

Group B (BSC101F, BSC103A, ESC102A/21, ESC103, ESC104A/21, BSC104A, ESC105)

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 1st YEAR (SEMESTER – II) MECHANICAL ENGINEERING (2023-24)

Course Notation	Course Code	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examinations		Total Marks	Credits	Course Type
			L	T	P	Total		Theory	Practical			
A	BSC-101F	Physics (Introduction to Electromagnetic Theory)	3	1	-	4	25	75	-	100	4	BSC
C	BSC-106A	Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variables)	3	1	-	4	25	75	-	100	4	BSC
B	ESC-101A	Basic Electrical Technology	3	1	-	4	25	75	-	100	4	ESC
A	ESC-102A/21	Engineering Graphics and Drawing	-	-	4	4	30	-	70	100	2	ESC
B	BSC-102	Chemistry	3	1	-	4	25	75	-	100	4	BSC
A	ESC-103	Programming for Problem Solving	3	-	-	3	25	75	-	100	3	ESC
C	ESC-106A/21	Workshop-II	-	-	4	4	30	-	70	100	2	ESC
B	HSMC-101	English	2	-	-	2	25	75	-	100	2	HSMC
A	BSC-104A	Physics Electromagnetic Lab	-	-	3	3	15	-	35	50	1.5	BSC
B	ESC-107A	Basic Electrical Technology Laboratory	-	-	2	2	15	-	35	50	1	ESC
B	BSC-105	Chemistry Laboratory	-	-	3	3	15	-	35	50	1.5	BSC
A	ESC-105	Programming for Problem Solving lab	-	-	4	4	15	-	35	50	2	ESC
B	HSMC-102	English Lab	-	-	2	2	15	-	35	50	1	HSMC
C	MCEVS-01	Environment and Ecology	3	-	-	3	25	75	-	100	3	BSC

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

Important Notes:

Significance of the Course Notations used in this scheme: -

C = These courses are common to both the groups Group-A and Group-B.

A = Other compulsory courses for Group-A.

B = Other compulsory courses for Group-B.

Students will study either (As per the group choice in Semester I: in one semester he will choose group A and in another group B)

Group A (ESC-101A, BSC-102, HSMC-101, ESC-107A, BSC-105, HSMC-102, BSC-106A, ESC-106A/2, MCEVS-01)

OR

Group B (BSC-101F, ESC-102A/21, ESC-103, BSC-104A, ESC-105, BSC-106A, ESC-106A/21, MCEVS-01)

J.C.BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – III) MECHANICAL ENGINEERING (2023-24)

Course Code	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theo	Practica			
PCC-ME-301/21	Thermodynamics	3	1	-	4	25	75	-	100	4	PCC
PCC-ME-302/21	Strength of Materials-I	3	1	-	4	25	75	-	100	4	PCC
PCC-ME-303/21	Fluid Mechanics and Machines	3	1	-	4	25	75	-	100	4	PCC
ESC-201	Basics of Electronics Engineering	3	-	-	3	25	75	-	100	3	ESC
ESC-203A/21	Engineering Mechanics	3	1	-	4	25	75	-	100	4	ESC
BSC-201	Mathematics III	3	-	-	3	25	75	-	100	3	BSC
BSC-01	Biology	3	-	-	3	25	75	-	100	3	BSC
PCC-ME-304/21	Strength of Materials Lab	-	-	2	2	15	-	35	50	1	PCC
PCC-ME-305/21	Fluid Mechanics and Machines Lab	-	-	2	2	15	-	35	50	1	PCC
SEC-WS-301/21	Workshop- III	-	-	4	4	30	-	70	100	2	SEC
	Total	**21**	**4**	**8**	**33**	**235**	**525**	**140**	**900**	**29**	

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
I Workshop exam will be of 03 hours duration

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – IV) MECHANICAL ENGINEERING (2023-24)

Course Code	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
PCC-ME-401/21	Applied Thermodynamics	3	1	-	4	25	75	-	100	4	PCC
PCC-ME-402/21	Materials Engineering	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-	Kinematics of	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-	Strength of Materials-II	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-405/21	Manufacturing Processes	3	-	-	3	25	75	-	100	3	PCC
MCEVS-02	National Resources and Biodiversity Conservation	3	-	-	3	25	75	-	100	3	BSC
PCC-ME-406/21	Thermal Lab- I	-	-	2	2	15	-	35	50	1	PCC
PCC-ME-407/21	Materials Engineering Lab	-	-	2	2	15	-	35	50	1	PCC
PCC-ME-408/21	Kinematics of Machines Lab	-	-	2	2	15	-	35	50	1	PCC
SEC-	Project I	-	-	4	4	30	-	70	100	2	SEC
SEC-WS-	Workshop- IV	-	-	4	4	30	-	70	100	2	SEC
	Total	**18**	**1**	**14**	**33**	**255**	**450**	**245**	**950**	**26**	

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

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – V) MECHANICAL ENGINEERING (2023-24)

Course Code	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practic			
PCC-ME-501/21	Heat and Mass Transfer	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-502/21	Dynamics of Machines	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-503/21	Design of Machine Elements- I	3	1	-	4	25	75	-	100	4	PCC
PCC-ME-504/21	Refrigeration and Air- conditioning	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-505/21	Industrial Engineering	3	-	-	3	25	75	-	100	3	PCC
	Open Elective Course- I	3	-	-	3	25	75	-	100	3	OEC
PCC-ME-506/21	Thermal Lab- II	-	-	2	2	15	-	35	50	1	PCC
PCC-ME-507/21	Dynamics of Machines Lab	-	-	2	2	15	-	35	50	1	PCC
MC – 02	Essence of Indian Traditional Knowledge	2	-	-	2	25*	75*	-	-	-	MAC
SEC-WS-501/21	Workshop-V	-	-	4	4	30	-	70	100	2	SEC
	Total	**20**	**1**	**8**	**29**	**210**	**450**	**140**	**800**	**23**	

Note: Exams duration will be as under
(a) Theory exams will be of 03 hours duration.
(b) Practical exams will be of 02 hours duration
I Workshop exam will be of 03 hours duration
(d) *Audit course; Marks and Credits are not to be counted but course is mandatory to pass

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – VI) MECHANICAL ENGINEERING (2023-24)

Course Code	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
PCC-ME-601/21	CAD/ CAM	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-602/21	Manufacturing Technology	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-603/21	Design of Machine Elements- II	3	-	-	3	25	75	-	100	3	PCC
	Programme Elective Course-I	3	-	-	3	25	75	-	100	3	PEC
	Programme Elective Course-II	3	-	-	3	25	75	-	100	3	PEC
	Open Elective Course- II	3	-	-	3	25	75	-	100	3	OEC
MCEVS-03	Environment Pollution, Waste Management and Sanitation	3	-	-	3	25	75	-	100	3	BSC
PCC-ME-604/21	CAD/ CAM Lab	-	-	2	2	15	-	35	50	1	PCC
MC-04G	Message of Bhagavad Gita	2	-	-	2	25*	75*	-	-	-	MAC
SEC-601/21	Project II	-	-	4	4	30	-	70	100	2	SEC
SEC-WS-601/21	Workshop-VI	-	-	4	4	30	-	70	100	2	SEC
	Total	**23**	**-**	**10**	**33**	**250**	**525**	**175**	**950**	**26**	

Note: Exams Duration will be as under

(a) Theory exams will be of 03 hours duration.
(b) Practical exams will be of 02 hours duration
(c) Workshop exam will be of 03 hours duration
(d) *Audit course; Marks and Credits are not to be counted but course is mandatory to pass

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4th YEAR (SEMESTER – VII/ VIII) MECHANICAL ENGINEERING (2023-24)

Course Code	Course Title	Teaching Schedule				Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits	Course Type
		L	T	P	Total		Theory	Practical			
PCC-ME-701/21	Automation in Manufacturing	3	-	-	3	25	75	-	100	3	PCC
PCC-ME-702/21	Operations Research	3	-	-	3	25	75	-	100	3	PCC
	Programme Elective Course-III	3	-	-	3	25	75	-	100	3	PEC
	Programme Elective Course-IV	3	-	-	3	25	75	-	100	3	PEC
	Programme Elective Course- V	3	-	-	3	25	75	-	100	3	PEC
	Open Elective Course- III	3	-	-	3	25	75	-	100	3	OEC
SEC-701/21	Project III	-	-	4	4	30	-	70	100	2	SEC
SEC-WS-701/21	Workshop-VII	-	-	4	4	30	-	70	100	2	SEC
	Total	**18**	**-**	**8**	**26**	**210**	**450**	**140**	**800**	**22**	

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 4th YEAR (SEMESTER – VIII/ VII) MECHANICAL ENGINEERING (2023-24)

Credits: 10 (SEC)

S. No.	Course Code	Title	Schedule	Credits	Examination Schedule (Marks)		
					Annual Exam	Continuous Assessment	Total
1.	SEC-801/21	Industrial Training	One Semester	10	350	150	500

Procedure for Annual Exam and Continuous Assessment of Industrial Training:

(A) Annual Exams Marks

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

(B) Continuous Assessment Marks

1. Assessment by University / Institute Faculty 50 Marks
2. Assessment by Industrial Guide 50 Marks
3. Conduct Marks 50 Marks

Total: 500 Marks

BSC-103A MATHEMATICS I

(Calculus and Linear Algebra)

B. Tech (Mechanical Engineering) I 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: Mathematics II

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

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

CO1- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

CO2- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

CO3- The tool of power series and Fourier series for learning advanced Engineering Mathematics.

CO4- To deal with functions of several variables that are essential in most branches of engineering.

CO5- The essential tool of matrices and linear algebra in a comprehensive manner.

Course Contents:

Unit 1

Calculus: Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. **(8)**

Unit 2

Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima. **(8)**

Unit 3

Sequences and Series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem. **(12)**

Unit 4

Multivariable Calculus (Differentiation): Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence. **(10)**

Unit 5

Matrices: Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation. **(12)**

Recommended/ Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi.
5. D. Poole, Linear Algebra: A Modern Introduction, Brooks/Cole.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

ESC-101A BASIC ELECTRICAL TECHNOLOGY

B. Tech (Mechanical Engineering) I/II 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: Basic Electronics Engineering, Air Conditioning Equipments

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

CO1- Analyze and solve D. C. networks by different analysis methods and theorems.

CO2- Formulate and solve complex AC single phase and three circuits.

CO3- Identify the type of electrical machines and their applications.

CO4- Introduce the components of low voltage electrical installations.

Course Contents:

Unit 1

DC Circuits: Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. **(10)**

Unit 2

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. **(10)**

Unit 3

Poly Phase Systems: Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (star and delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method. **(7)**

Unit 4

Transformers: Magnetic Circuits, construction and working of single phase transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto-transformer **(7)**

Unit 5

Electrical Machines: *Induction motor***:** Construction, principle and working of a three-phase induction motor, Single-phase induction motor: Construction, principle and working, Applications

*DC machine***:** Construction, principle and working of dc motor and generator. Applications

*Synchronous machine***:** Construction, principle and working of synchronous motor and generators. Applications. **(9)**

Unit 6

Electrical Installations: Components of LT Switchgear: Fuses, MCB, ELCB, MCCB, Types of Wires, Earthing, Power factor improvement. **(7)**

Recommended/ Reference Books:

1. D. P. Kothari and, I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
4. E. Hughes, "Electrical and Electronics Technology", Pearson.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.

Web Links:

1. **NPTL Web Course, Basic Electrical Technology,** Prof. G. D. Roy, Prof. N. K. De, Prof. T.K. Bhattacharya, IIT Kharagpur
(https://nptel.ac.in/courses/108/105/108105053/)

2. **NPTL Web Course, Electrical Machines-I,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras
(https://nptel.ac.in/courses/108/106/108106071/)

3. **NPTL Web Course, Electrical Machines-II,** Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr. Krishna Vasudevan, IIT Madras
https://nptel.ac.in/courses/108/106/108106072/

BSC-102 CHEMISTRY
(Concepts in Chemistry for Engineering)
B. Tech (Mechanical Engineering) I/II 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: Environment Science

Course Objectives:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

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

CO1- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2- Rationalise bulk properties and processes using thermodynamic considerations.

CO3- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5- List major chemical reactions that are used in the synthesis of molecules.

Course Contents:

Unit 1

Atomic and molecular structure: Schrodinger equation. Particle in aboxsolutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transitionmetal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. **(12)**

Unit 2

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules.

Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering. **(9)**

Unit 3

Intermolecular forces and potential energy surfaces: Ionic, dipolar and vanDer Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2 F and HCN and trajectories on these surfaces. **(5)**

Unit 4

Use of free energy in chemical equilibria: Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams. **(8)**

Unit 5

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **(6)**

Unit 6

Stereochemistry: Representations of 3 dimensional structures, structural isomers and stereo isomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism initransitional metal compounds. **(6)**

Unit 7

Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule. **(5)**

Recommended/ Reference Books:

1. University Chemistry, by B. H. Mahan.
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane.
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
5. Physical Chemistry, by P. W. Atkins.
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E.Schore.

HSMC-101 ENGLISH

B. Tech (Mechanical Engineering) I/II Semester

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

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

Pre- Requisite: Nil

Successive: Nil

Course Contents:

Unit 1

Vocabulary Building: The concept of Word Formation; Root words from foreign languages and their use in English; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms, and standard abbreviations.

Unit 2

Basic Writing Skills: Sentence Structures; Use of phrases and clauses in sentences; Importance of proper punctuation; Creating coherence; Organizing principles of paragraphs in documents; Techniques for writing precisely.

Unit 3

Identifying Common Errors in Writing: Subject-verb agreement; Noun-pronoun agreement;

Misplaced modifiers; Articles; Prepositions; Redundancies; Clichés.

Unit 4

Nature and Style of sensible Writing: Describing; Defining; Classifying; Providing examples or evidence.

Unit 5

Writing introduction and conclusion

Unit 6

Writing Practices: Comprehension; Précis Writing; Essay Writing.

ESC-107A BASIC ELECTRICAL TECHNOLOGY LABORATORY

B. Tech (Mechanical Engineering) I/II Semester

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

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

Pre- Requisite: Basic Electrical Technology

Successive: Nil

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

CO1- Get an exposure to common electrical components and their ratings.

CO2- Make electrical connections by wires of appropriate ratings.

CO3- Understand the usage of common electrical measuring instruments.

CO4- Understand the basic characteristics of transformers and electrical machines.

CO5- Get an exposure to the working of power electronic converters.

List of Experiments/ Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

2. Verification of network theorem in DC circuits, Thevenin's Theorem, Norton's, Theorem, Superposition Theorem etc.

3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.

4. Poly phase systems, three phase connections (star and delta), measurement of three phase power.

5. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

6. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

7. Torque Speed Characteristic of separately excited dc motor.
8. Components of LT switchgear.

BSC-105 CHEMISTRY LABORATORY

B. Tech (Mechanical Engineering) I/II Semester

No. of Credits: 1.5
L T P Total
0 0 3 3

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

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

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

CO1- Estimate rate constants of reactions from concentration of reactants/products as a function of time.

CO2- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water etc.

CO3- Synthesize a small drug molecule and analyze a salt sample.

List of Experiments (Choice of 10-12 from the following):

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Colligative properties using freezing point depression.
6. Determination of the rate constant of a reaction.
7. Determination of cell constant and conductance of solutions.
8. Potentiometry-determination of redox potentials and emfs.
9. Synthesis of a polymer/drug.
10. Saponification/ acid value of an oil.
11. Chemical analysis of a salt.

12. Lattice structures and packing of spheres.

13. Models of potential energy surfaces.

14. Chemical oscillations-Iodine clock reaction.

15. Determination of the partition coefficient of a substance between two immiscible liquids.

16. Adsorption of acetic acid by charcoal.

17. Use of the capillary viscosimeters to demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

HSMC-102 ENGLISH LAB

B. Tech (Mechanical Engineering) I/II Semester

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

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

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

List:

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Communication at Workplace.
5. Interviews.
6. Formal Presentations.

Recommended/ Reference Books:

1. Practical English Usage. Michael Swan.OUP.
2. Remedial English Grammar. F. T. Wood. acmillan.
3. On Writing Well. William Zinsser. Harper Resource Book.
4. Study Writing. Liz Hamp- Lyons and Ben Heasly. Cambridge University Press.
5. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press.
6. Exercises in Spoken English. Parts. I- III CIEFL, Hyderabad. Oxford University Press.

ESC-104A/21 WORKSHOP-I

B. Tech (Mechanical Engineering) I Semester

No. of Credits: 2		Sessional:	30Marks
L T P Total		Practical:	70 Marks
0 0 4 4		Total :	100Marks
		Duration of Exam:	3Hours

Pre- Requisite: Nil

Successive: Workshop- II, Workshop- III, Workshop- IV, Workshop- V, Workshop- VI, Workshop- VII

PART-A

Computer Engineering Workshop

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

CO1- Acquire skills in basic engineering practice.

CO2- Have working knowledge of various equipments used in workshop.

CO3- Have hands on experience about various machines and their components.

CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

List of Exercises:

1. To study and demonstrate Block diagram of Digital Computer System and explanation of each unit.
2. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
3. To study and demonstrate primary memory and secondary memory.
4. To demonstrate Mother Board/ Main Board and its parts, Chipset, Connectors, Add On Card.
5. To study various processor (Pentium-I, II, III, DUAL Core, i-3, i-5, i-7 etc).
6. To study various types of monitors: LCD /LED/TFT/PLASMA DISPLAY& New Technologies
7. To study different printer types and their working.
8. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus:

Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss

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

PART-B
Electrical Workshop

List of Exercises:

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

PART- C
Electronics Workshop

List of Exercises:

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.

2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.

3. To study and demonstrate multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.

4. To study and demonstrate Vp (peak voltage),Vpp (peak to peak voltage), Time, frequency and phase using CRO.

5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.

6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.

7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.

8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.

9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and wave form observation.

10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

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

BSC-101F PHYSICS
(Introduction to Electromagnetic Theory)
B. Tech (Mechanical Engineering) II/I 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: Mathematics course with vector calculus

Successive: Nil

Course Contents:

Unit 1

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Boundary conditions of electric field and electrostatic potential, Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab. **(8)**

Unit 2

Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities, Magnetization and associated bound currents; Boundary conditions on Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility . **(8)**

Unit 3

Magnetic materials and Faraday's law: Ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials. Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications. **(8)**

Unit 4

Displacement current, Magnetic field due to time-dependent electric field: Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time- dependent electric field; calculating magnetic field due to changing electric fields in quasi- static approximation. Maxwell's equation in vacuum and non-conducting medium; electromagnetic wave equation and energy in an electromagnetic field; Flow of energy and Poynting vector. **(8)**

Recommended/ Reference Books:

1. David Griffiths, Introduction to Electrodynamics

2. Halliday and Resnick, Physics
3. W. Saslow, Electricity, magnetism and light

BSC-106A MATHEMATICS II

(Calculus, Ordinary Differential Equations and Complex Variable)

B. Tech (Mechanical Engineering) II 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: Mathematics course with vector calculus

Successive: Nil

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes (COs): At the end of the course, the student will learn:

CO1- The mathematical tools needed in evaluating multiple integrals and their usage.

CO2- The effective mathematical tools for the solutions of differential equations that model physical processes.

CO3- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Course Contents:

Unit 1

Multivariable Calculus (Integration): Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. **(12)**

Unit 2

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. **(8)**

Unit 3

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. **(10)**

Unit 4

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. **(10)**

Unit 5

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. **(10)**

Recommended/ Reference Books:

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson.

(ii) Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.

(iii) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India.

(iv) S. L. Ross, Differential Equations, Wiley India.

(v) E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hal India.

(vi) E. L. Ince, Ordinary Differential Equations, Dover Publications.

(vii) J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc- Graw Hill.

(viii) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,.

(ix) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

ESC- 103 PROGRAMMING FOR PROBLEM SOLVING

B. Tech (Mechanical Engineering) II/I 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: Nil

Course Outcomes (COs): At the end of the course, the student will learn:

CO1- To formulate simple algorithms for arithmetic and logical problems.

CO2- To translate the algorithms to programs (in C language).

CO3- To test and execute the programs and correct syntax and logical errors.

CO4- To implement conditional branching, iteration and recursion.

CO5- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO6- To use arrays, pointers and structures to formulate algorithms and programs.

CO7- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO8- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Course Contents:

Unit 1

Introduction to Programming: (4)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). **(1)**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples. **(1)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. **(2)**

Unit 2

Arithmetic expressions and precedence **(2)**

Conditional Branching and Loops **(6)**

Writing and evaluation of conditionals and consequent branching **(3)**

Iteration and loops **(3)**

Unit 3

Arrays: Arrays (1-D, 2-D), Character arrays and Strings **(6)**

Unit 4

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).**(6)**

Unit 5

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference **(5)**

Unit 6

Recursion: Recursion, as a different way of solving problems. Example Programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort. **(4-5)**

Unit 7

Structure: Structures, Defining structures and Array of Structures. **(4)**

Unit 8

Pointers

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation). **(2)**

Unit 9

File handling (only if time is available, otherwise should be done as part of the lab)

Recommended/ Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. E. Balaguruswamy, Programming in ANSIC, Tata Mc Graw-Hill.
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall.

MCEVS-01 ENVIRONMENT AND ECOLOGY

B. Tech (Mechanical Engineering) II Semester

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

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

Pre- Requisite: Nil

Successive: Nil

Course Outcomes (COs): At the completion of this course, the learner will be able to:

CO1- Demonstrate knowledge of basics related to Environment and its components.

CO2- Understand the concepts of population ecology and human population

CO3- Analyze components of ecosystems and compare them with real life processes.

CO4- Interpret ecological phenomena of different ecosystems.

Course Contents:

Unit 1

Introduction to Environmental Studies: Definition and Components of Environment, Relationship between the different components of Environment. Concept of biosphere, Atmosphere, lithosphere and hydrosphere;Components of atmosphere, Man and Environment Relationship, Impact of technology on Environment.

The Multidisciplinary nature of environmental studies. Definition; Scope and importance, need for public awareness.

Unit 2

Human population and Environment: Population growth, vanat1on among nations. Population explosion -Causes, Effects and Control, Family welfare programme. Human right. Value Education, Women and Child Welfare.

Population Interactions and Adaptations: Neutralism; positive interactions- commensalism, proto cooperation, mutualism and symbiosis; negative interactions- competition, predation and parasitism; importance of negative interactions. Invasive species and pest control.

Unit 3

Concept of Ecosystem: Concept of an ecosystem. Definition, scope and significance of Ecology, Concept of habitat and ecological niche, Structure and function of an Ecosystem.Producers. Consumers and decomposers. Energy flow in the ecosystem. Ecological succession.

Food chairs, food web and ecological pyramids.

Unit 4

Biomes: Concept; major biomes of the world; Introduction, types, characteristic features, structure and function of the following ecosystems: - Forest ecosystem Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Reference Books:

1. Brewer, R. The Science of Ecology, Sanders College Publishing Co.,Tokyo, 1994.
2. Odum, E. P. Basic Ecology, W.B. Saunders, Philadelphia, 1983.
3. Jorgensen, Sven Erik. Encyclopedia of' Ecology. Vol 1-5. Elsevier Publishers. Netherlands, 2008.
4. Kohli, R. K., Jose, S., Singh, 1--1. P. and Batish, D. R. invasive Plants and Forest Ecosystems. CRC Press / Taylor and Francis, 2009.
5. Odum, E.P., Barrick, M. and Barrett, G. W. Fundamentals of Ecology (5th Ed). Thomson Brooks/Cole Publisher, California, 2005.
6. Rana, S.V.S. Essentials of Ecology and Environmental Science (5th Ed), PHI Learning Pvt. Ltd, 2013 .
7. Sharma, P.O. Ecology and Environment. Rastogi Publications. New Delhi, 20I6.
8. Smith, R.L. (1996), Ecology and Field Biolog·y, Harper Collins, New York.
9. Smith, T.M and Smith, R.L. Elements of Ecology (8th Ed), Benjamin Cummings, 2012.
10. Vandermeer, John H., Riddle, B.R. and Brown, J.H. Population Ecology: First principle (2nd Ed). Princeton University Press, 2013.
11. Singh, J.S., Singh, S.P. and Gupta, S.R. (2015). Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.

Suggested Web Sources:

1. http: //cnvisnic.in/l :NVIS html/l_NVISSubjcct/s ubjcct.html

2 https://nptel.ac.in/courses/103/106/103106162/

3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14

4. https://swayam.gov.in/

BSC-104A PHYSICS ELECTROMAGNETIC LAB

B. Tech (Mechanical Engineering) II/I Semester

No. of Credits: 1.5
L T P Total
0 0 3 0

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

List of Experiments:

At least 06 experiments from the following

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan`s law of radiation and to determine Stefan's constant.
12. To determine Boltzmann constant using V-I characteristics of PN junction diode.

Note: Experiments may be added or deleted as per the availability of equipments.

Recommended/ Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.
3. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, Springer.

ESC- 105 PROGRAMMING FOR PROBLEM SOLVING LAB

B. Tech (Mechanical Engineering) II/I Semester

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

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

Course Outcomes (COs): At the end of the course, the student will learn:

CO-1 To formulate the algorithms for simple problems.

CO2- To translate given algorithms to a working and correct program.

CO3- To be able to correct syntax errors as reported by the compilers.

CO4-To be able to identify and correct logical errors encountered at run time.

CO5- To be able to write iterative as well as recursive programs.

CO6- To be able to represent data in arrays, strings and structures and manipulate them through a program.

CO7- To be able to declare pointers of different types and use them in defining self-referential structures.

CO8- To be able to create, read and write to and from simple text files.

Tutorial 1: Problem solving using computers:

Lab 1: Familiarization with programming environment.

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions.

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1 D Arrays: searching, sorting:

Lab 5: 1 D Array manipulation

Tutorial 6: 2 D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

ESC- 102A/21 ENGINEERING GRAPHICS AND DRAWING

B. Tech (Mechanical Engineering) II/I Semester

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

Sessional: 30 Marks
Practical: 70 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre- Requisite: Nil

Successive: CAD/CAM

Course Objectives:

The objective of studying this course is to understand the basic principles of engineering drawing and graphics and to apply the same to daw different types of projections.

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

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

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

CO 3- Learn about the projections of sectioning of solids in different orientations and development of surfaces.

CO 4- Draw orthographic and isometric view of an object.

CO 5- Learn about the basics of AUTOCAD

Course Contents:

Unit 1:

Introduction: Importance, Significance and scope of Engineering Drawing, Usage of drawing Instruments, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic projections of simple engineering objects, B.I.S Specifications. **(12)**

Unit 2:

Projection of Points & Lines: Introduction of plane of projection, reference & auxiliary planes, projection of points and line in different quadrants, traces, inclinations & true lengths of the lines, projections on auxiliary plane, shortest distance intersecting and non intersecting lines. **(8)**

Unit 3:

Projection of Planes and Solids: Parallel to one reference plane, inclined to one plane but perpendicular to the other, inclined to both reference planes. Projection of Polyhedra, solids of revolution-in simple positions with axis perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other. **(8)**

Unit 4:

Sectioning of Solids and Development of Surfaces: Projections of sections of prisms, pyramids, cylinders and cones. Development of simple object with and without sectioning. **(4)**

Unit 5:

Isometric Projections: Introduction, isometric scale, Isometric view of plane figures, prisms, pyramids and cylinders. **(4)**

Unit 6:

Overview of Computer Graphics: Introduction to AUTOCAD and practice of simple exercises related to the above units on CAD Software. **(8)**

Recommended/ Reference Books:

1. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.

2. A Text Book of Machine Drawing - P S Gill Pub.: S K Kataria & Sons.

3. A Text Book of Engineering Drawing and Machine Drawing by M. L. Aggarwal and Sandhya Dixit: Dhanpat Rai & Co.

4. Textbook on Engineering Drawing , K. L. Narayana and P. Kannaiah, Scitech Publichers

Web Links:

S.N	Address of web source	Content
1.	https://youtu.be/2C8H2rIwhrA	Engineering Drawing
2.	https://youtu.be/xzi_R8lims0	Drawing Layouts

ESC-106A/21 WORK SHOP-II
B. Tech (Mechanical Engineering) II Semester

MECHANICAL ENGINEERING WORKSHOP

No. of Credits: 2		Sessional:	30Marks
L T P Total		Practical:	70 Marks
0 0 4 4		Total :	100Marks
		Duration of Exam:	3 Hours

Pre- Requisite: Workshop -I
Successive: Workshop- III, Workshop- IV, Workshop- V, Workshop- VI, Workshop- VII

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

CO 1- Acquire skills on basic engineering materials and safety aspects.
CO 2- Understand the fundamental concept of various basic engineering practices namely fitting, sheet metal, carpentry, pattern making and welding etc.
CO 3- Learn and use different marking & measuring instruments used in machine shop, fitting shop, sheet metal shop, carpentry & pattern making shop etc.
CO 4- Practice real time job preparation using various operations related to fitting, sheet metal, carpentry, welding & foundry etc.

List of Exercises:
Machine shop, fitting shop, sheet metal shop, carpentry & pattern making shop, welding shop, foundry shop, forging (smith) shop and injection moulding shop.

Section (A): Machine Shop

1. To understand the layout, safety measures and fundamental concept of different engineering materials used in the workshop.
2. To study and demonstrate the various parts, specifications & operations on lathe, milling and shaping machine.
3. To study different types of measuring tools used in metrology and determine the least count of vernier calipers, vernier height gauges and micrometers.

Section (B): Fitting & Sheet Metal Shop

4. To study different types of tools, equipments, devices and machines used in fitting shop.
5. To prepare a job involving filing, drilling, tapping and hacksaw cutting operations on mild steel plate.
6. To study various types of sheet metal tools and prepare a simple sheet metal joint.

Section (C): Carpentry and Pattern Making Shop

7. To study various types of carpentry and pattern making tools and equipments.

8. To prepare a simple wooden joint (cross lap / Tee-lap/dovetail joint) using kail wood in carpentry shop.
9. To prepare single piece pattern / split pattern using kail wood in pattern making shop.

Section (D): Welding Shop

10. To practice striking an arc and prepare straight short bead on given M.S plate in flat positionby arc welding.
11. To prepare straight continuous bead and re start of electrode in flat position by arc welding on given M.S. plate as per size.
12. To practice tack weld &close butt joint in flat position by arc welding on given M.S. plate as per size.

Section (E): Foundry, Forging (Smithy) & Injection Moulding shop

13. To study various types of foundry tools and prepare a mould cavity using single/split pattern in moulding sand.
14. To study various types of forging / black smithy tools and prepare a ring or hook by hand forging operation.
15. To study the working of injection molding machine and prepare a simple component by injection moulding.

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

PCC-ME-301/21 THERMODYNAMICS

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: 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 behaviour of pure substances to solve engineering problems.

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

CO1- Understand the basic concepts of thermodynamics and apply energy balance to systems and control volumes, in situations involving heat and work interactions.

CO2- Learn to differentiate between high grade and low grade energies and understand the Second law limitations on energy conversion.

CO3- Evaluate properties of pure substances, gases and their mixtures in various processes.

CO4- Analyze performance of energy conversion devices and cycles.

Course Contents:

Unit 1

Fundamental Concepts: Introduction, System & Control volume; Types of systems, Property, State & Process; Concept of Thermodynamic Equilibrium, Quasistatic Process, Exact & Inexact differentials; Work - Thermodynamic definition of work; Displacement work; Path dependence of displacement work. Definition of heat; examples of heat/ work interaction in systems; Numerical Problems related to Heat and Work. **(6)**

Unit 2

Temperature and First law: Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers. First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Energy: a property; Various modes of energy, Internal energy and Enthalpy. Numerical Problems on Thermometry and First Law. **(7)**

Unit 3

First Law for Flow Processes: Derivation of general energy equation for a control volume; Steady state steady flow processes; Examples of steady flow devices like nozzles, turbines, compressors and heat exchangers; Unsteady flow processes; Throttling and Free expansion processes. Numerical Problems on Steady Flow processes. **(6)**

Unit 4

Second Law of Thermodynamics and Entropy: Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements and their equivalence; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Carnot theorem; Absolute temperature scale.

Clausius inequality; Definition of entropy S ; Entropy S: a property; Principle of increase of entropy and its applications; Illustration of processes in T-s coordinates; Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes. Numerical Problems on Second law and Entropy. **(12)**

Unit 5

Properties of Pure Substances and Gas Mixtures: Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases, 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 Mollier's chart; Identification of states & determination of properties,. Numerical Problems related to ideal gases and steam. **(10)**

Unit 6

Thermodynamic Cycles: Air Standard Otto, Diesel and Dual cycles; their comparison; Basic Brayton cycle. Numerical Problems. **(9)**

Recommended/ Reference Books:

1. Nag, P.K, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

2. Jones, J. B. and Duggan, R. E., Engineering Thermodynamics, Prentice-Hall of India

3. Moran, M. J. and Shapiro, H. N., Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

4. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., Fundamentals of Thermodynamics, John Wiley and Sons.

Web Links:

S.No.	Address of Web Source	Content
1	https://nptel.ac.in/courses/112/105/112105266/	Unit 5: Properties of Pure Substances

2	https://nptel.ac.in/courses/112/104/112104113/	Unit 1 and 2: Fundamentals of Energy Conversion
3	https://nptel.ac.in/courses/101/104/101104063/	Unit 3 and 4 Laws of Thermodynamics
4	https://nptel.ac.in/courses/112/105/112105123/	Unit 6 Thermodynamic Cycles

PCC-ME-302/21 STRENGTH OF MATERIALS-I
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: Physics, Mathematics II and Engineering Mechanics
Successive: Advanced Strength of Materials, Design of Machine Elements-I, Design of Machine Elements-II

Course Objectives:

The objective of studying this course isto understand the nature of stresse and elastic deformation developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres under various loading conditions.

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

CO1- Analyze the static stresses and strains within the elementary structural members.

CO2- Evaluate shear force, bending moment and their distribution under transverse loading.

CO3- Understand the basic terminology and concepts for slope and deflection of beams.

CO4- Determine the stresses and strains in the members subjected to axial, bending and torsion loads.

CO5- Apply the concept of stresses in pressure vessels.

Course Contents:

Unit 1

Stress, Strain and Deformation of Solids: Rigid bodies and deformable solids, Tension, Compression and Shear Stresses, Hooke's law, Elastic constants and their relations, Plastic behavior of materials, Deformation of simple and compound bars, Thermal stresses, Volumetric strains, Stresses on inclined planes, principal stresses and principal planes, Mohr's circle of stress. Numerical Problems. **(9)**

Unit 2

Transverse Loading on Beams and Stresses in Beams: Types of beams, Transverse loading, Shear force and bending moment in beams, Cantilevers, Simply supported beams and over-hanging beams under point, uniformly distributed and uniformly varying loads, Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, Load carrying capacity, Proportioning of section. **(14)**

Unit 3

Deflection of Beams: Double Integration method, Macaulay's method, Area moment method for computation of slopes and deflections in beams, Conjugate beam and strain energy, Castigliano's & Maxwell's theorems. **(9)**

Unit 4

Torsion: Torsion formulation stresses and deformation in circular and hollows shafts, Stepped shafts, Deflection in shafts fixed at the both ends, Stresses in helical springs, Deflection of helical springs, carriage springs. **(9)**

Unit 5

Thin Cylinders, Spheres and Thick Cylinders: Stresses in thin cylindrical shell due to internal pressure, circumferential and longitudinal stresses and deformation in thin and thick cylinders, spherical shells subjected to internal pressure, Deformation in spherical shells, Lame's theorem. **(9)**

Recommended/ Reference Books:

1. Strength of Materials by G.H.Ryder, Macmillan Publishers India Limited.

2. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi.

2. R. Subramanian, Strength of Materials, Oxford University Press.

3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Web Links:

S.No.	Address of web source	Content
1	https://nptel.ac.in/courses/112/107/112107146/	Stress, Strain and Deformation of Solids
2	https://www.youtube.com/watch?v=sP34uzn7diA	Transverse Loading on Beams and Stresses in Beams
3	https://www.youtube.com/watch?v=9Mm5YJkma-0	Transverse Loading on Beams and Stresses in Beams
4	https://www.youtube.com/watch?v=IQB0bJRCRxo https://www.youtube.com/watch?v=CnONQoxubLw https://www.youtube.com/watch?v=zET8EKFnHFE	Torsion
5	https://nptel.ac.in/content/storage2/courses/112105125/pdf/module-9%20lesson-2.pdf	Thin Cylinders, Spheres and Thick Cylinders
6	https://www.youtube.com/watch?v=GUOKSExdjq8 https://www.youtube.com/watch?v=vi0tjfDSjNY https://www.youtube.com/watch?v=q7G0RMtrKr8	Deflection of Beams

PCC-ME-303/21 FLUID MECHANICS AND FLUID MACHINES

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: Nil

Successive: Heat and Mass Transfer

Course Objectives:

The objective of this course is to enable the students to understand basics of Fluid Mechanics and Machines, laws of fluid mechanics, model testing and performance parameters for hydraulic machinery.

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

CO 1- Expediate the properties of fluid and basic fluid mechanics laws.

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

CO 3- Conceptualize the boundary layer, laminar and turbulent flow.

CO 4- Analyze the modeling of fluid flow problems.

CO5- Evaluate the performance of hydraulic turbines.

CO6- Evaluate the performance of hydraulic pumps.

Course Contents:

Unit 1

Introduction and Fluid Statics: Definition of fluid, Newton's law of viscosity, properties of fluids, mass density, specific volume, specific gravity, viscosity and surface tension, Stability of floating Bodies and Submerged bodies, Determination of metacentric height, Numerical Problems **(8)**

Unit 2

Fluid Kinematics and Fluid Dynamics: Different types of flows, Continuity equation, applications of continuity equation, momentum equation and its applications, Euler's equation, Bernoulli's equation and its applications, Venturimeter, Orificemeter, Rotameter, Numerical Problems **(8)**

Unit 3

Laminar flow through pipes and Boundary Layer: Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits, concept of boundary layer, measurement of boundary layer thickness, Von-Karman integral Momentum equation for boundary layer, Darcy Weisbach equation, friction factor, Numerical Problems. **(7)**

Unit 4

Dimensional Analysis: Need for dimensional analysis, methods of dimension analysis, Similitude, types of similitude, Dimensionless parameters, application of dimensionless parameters, similitude laws, Model testing, Model testing of turbines and pumps, Numerical Problems. **(7)**

Unit 5

Hydraulic Turbines: Euler's equation, theory of Rotodynamic machines, Introduction to hydro power plant, Classification of water turbines, heads and efficiencies, velocity triangles, Pelton turbine, Francis turbine, Kaplan turbines and their working principles, draft tube, Specific speed, unit quantities, performance curves for turbines, governing of turbines, Numerical Problems. **(10)**

Unit 6

Pumps: Centrifugal pumps: working principle, various heads and efficiencies, velocity components at entry and exit of the rotor, velocity triangles, work done by the impeller, performance curves. Reciprocating pump: Classifications, working principle, Indicator Diagram, Numerical Problems. **(10)**

Recommended/ Reference Books:

1 Mechanics of Fluids – I H Shames; McGraw Hill

2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar; S.K. Kataria and Sons.

3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas; TMH Publications, New Delhi.

4. Fluid Mechanics – Streeter V L and Wylie E B; McGraw Hill

5. Fluid Mechanics and Machinery – S.K. Agarwal; TMH; New Delhi.

6. Fluid Mechanics by Frank M. White; McGraw Hill.

Web Links:

1. https://nptel.ac.in/courses/112/104/112104118/
2. https://nptel.ac.in/courses/112/104/112104117/
3. https://nptel.ac.in/courses/112/105/112105183/
4. https://nptel.ac.in/courses/112/105/112105171/

ESC- 201 BASIC ELECTRONICS ENGINEERING
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: Physics

Successive: Mechatronics, Automation in Manufacturing

Course Objectives:

The objective of this course is to provide an overview of electronic device components to Mechanical engineering students.

Course Outcomes (COs): At the end of this course students will demonstrate the ability to

CO1- Understand the principles of semiconductor devices and their applications.

CO2- Design an application using Operational amplifier.

CO3- Understand the working of timing circuits and oscillators.

CO4- Understand logic gates, flip flop as a building block of digital systems.

CO5- 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. **(8)**

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. **(8)**

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. **(8)**

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, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications. **(8)**

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. **(8)**

Recommended/ Reference Books:

1. Floyd ," Electronic Devices" Pearson Education.

2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill.

3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill.

ESC-203A/21 ENGINEERING MECHANICS

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: Physics, Mathematics

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

Course Objectives:

The objective of this course is to provide an introduction of Engineering Mechanics fundamentals and applications.

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

CO 1- Understand the basic force system and equilibrium.

CO 2- Apply principles of friction in engineering problems.

CO 3- Understand the concepts of Structure analysis.

CO 4- Determine Centroid and understand the virtual work concept.

CO5- Analyze particle dynamics.

CO6- Understand the concepts of Kinematics and Kinetics of Rigid Bodies.

Course Contents:

Unit 1

Introduction to Engineering Mechanics: Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D, Rigid Body equilibrium. System of Forces: Coplanar and Concurrent Forces, Components of forces in Space, Resultant. Moment of Forces and its Application, Couples, Equilibrium of System of Forces, Equations of Equilibrium of Coplanar Systems and Spatial Systems. **(8)**

Unit 2

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. **(5)**

Unit 3

Structural Analysis: Equilibrium in three dimensions. Trusses: Method of Sections, Method of Joints, Zero force members. Beams & types of beams, Frames & Machines. **(7)**

Unit 4

Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity; 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**. (7)**

Unit 5

Virtual Work and Energy Methods: 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. **(7)**

Unit 6

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). **(8)**

Unit 7

Kinematics and Kinetics of Rigid Bodies: 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. **(8)**

Recommended/ Reference Books:

1. Irving H. Shames, Engineering Mechanics, Prentice Hall

2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, Tata McGraw Hill

3. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

4. Hibler and Gupta, Engineering Mechanics (Statics, Dynamics) by Pearson Education.

5. Reddy Vijaykumar K. and K. Suresh Kumar, Singer's Engineering Mechanics.

6. Bansal R.K., A Text Book of Engineering Mechanics, Laxmi Publications.

7. Khurmi R.S., Engineering Mechanics, S. Chand & Co.

8. Tayal A.K., Engineering Mechanics, Umesh Publications.

Web Links:

S.No.	Address of web source	Content
1.	https://youtu.be/tJw_-gx-i-0	Principle of Virtual Work: Lecture- 1
2.	https://youtu.be/6n61rjociHQ	Principle of Virtual Work: Lecture- 2
3.	https://youtu.be/zGsGupbv_SI	Energy Relations

4.	https://youtu.be/VQRcChR9IkU	Friction- Lecture- 1
5.	https://youtu.be/jpvt1D4jG9w	Friction- Lecture- 2
6.	https://youtu.be/BytusqcT_F0	Friction- Lecture- 3
7.	https://youtu.be/LBMHPeJNB4E	Particle Dynamics
8.	https://youtu.be/3-aNY5FtU6k	Circular Motion

BSC 201 MATHEMATICS III

B. Tech (Mechanical Engineering) III Semester

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

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

Pre- Requisite: Mathematics I and II

Successive: 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)**

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)**

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)**

Recommended/ Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.

2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.

3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.

4. S. Ross, A First Course in Probability, Pearson Education India.

BSC 01 BIOLOGY

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: Environmental Science

Course Objectives:

The objective of this course is 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:

CO1- Classify enzymes and distinguish between different mechanisms of enzyme action.

CO2- Identify DNA as a genetic material in the molecular basis of information transfer.

CO3- Analyze biological processes at the reductionist level

CO4- Apply thermodynamic principles to biological systems.

CO5- Identify and classify microorganisms.

Course Contents:

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, uricoteliec, ureotelic (e) Habitata- acquatic 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 give 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 has 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 earthEnzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyse 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

Macromolecular Analysis: Purpose: How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure.Primary secondary, tertiary and quaternary structure.Proteins as enzymes, transporters, receptors and structural elements. **(5)**

Unit 8

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 exergoinc reactions. Concept of Keq 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. **(4)**

Unit 9

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. **(3)**

Recommended/ Reference Books:

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, By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
4. Molecular Genetics, 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 Wm, C. Brown Publishers.

PCC-ME-304/21 STRENGTH OF MATERIALS LAB
B. Tech (Mechanical Engineering) III Semester

No. of Credits: 1	Sessional: 15 Marks
L T P Total	Practical: 35 Marks
0 0 2 2	Total : 50 Marks
	Duration of Exam: 02 Hours

Pre- Requisite: Strength of Materials

Successive: Strength of Materials -II, Design of Machine Elements-I, Design of Machine Elements-II

Course Objectives:

The objective of the Strength of Materials lab is to give insight to the students about various mechanical properties of the materials and perform such experiments on different machines/ equipments.

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

CO 1- Understand the concepts of mechanical properties for materials and testing methods.

CO 2- Measure and interpret hardness of materials on different machines/ equipments.

CO 3- Analyze impact properties of materials.

CO 4- Assess tensile, shear, compressive and other properties of materials on UTM.

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 and compare with Rockwell hardness.
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 Universal Testing Machine.
8. To perform the shear test on Universal Testing Machine.
9. To perform the torsion test on a Torsion Testing Machine.
10. To determine the Micro hardness of sample.
11. To study the fatigue testing of materials.
12. To determine the stiffness of helical spring.

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

PCC-ME-305/21 FLUID MECHANICS & MACHINES LAB

B. Tech (Mechanical Engineering) III Semester

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

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

Pre- Requisite: Nil

Successive: Heat and Mass Transfer

Course Objectives:

The objective of this lab is to learn about fluid properties and measure fluid flow losses, efficiencies, performance characteristics of hydraulic machines by performing various experiments.

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

CO 1- Understand the techniques and concept of stability.

CO 2- Measure and analyze discharge and hydraulic coefficients.

CO 3- Measure different types of pipe losses and determine the velocity profile in a Pipe.

CO 4- Analyze the performance characteristics of hydraulic turbines and pumps.

List of Experiments:

1. To verify the Bernoulli's Theorem.
2. To determine coefficient of discharge of Venturimeter.
3. To determine coefficient of discharge of Orifice meter.
4. To determine the coefficient of discharge of a Notch (V and Rectangular types).
5. To determine the friction factor for the pipes.
6. To determine the coefficient of contraction, velocity and discharge of an orifice.
7. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
8. To determine the impact of jet on the different type of vanes.
9. To draw the constant head; constant-speed and constant efficiency curves of Pelton turbine.
10. To draw the constant head; constant speed and constant efficiency curves of Francis turbine.
11. To draw the constant head; constant speed and constant efficiency curves of Kaplan turbine.
12. To study the constructional details and draw the characteristic curves of Centrifugal pump.
13. To study the constructional details and draw the characteristic curves of Reciprocating pump.
14. To study the constructional details of hydraulic RAM and determine its various efficiencies.

Web Links:

S.No.	Address of web source	Content
1	http://fm-nitk.vlabs.ac.in/#	To determine coefficient of discharge of

		Venturimeter.
2	http://fm-nitk.vlabs.ac.in/#	To determine the coefficient of discharge of a Notch (V and Rectangular types).
3	http://fm-nitk.vlabs.ac.in/#	To determine the friction factor for the pipes.
4	https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html?domain=Civil%20Engineering	To verify the Bernoulli's Theorem.
5	https://eerc03-iiith.vlabs.ac.in/exp6/Introduction.html?domain=Civil%20%20%20%20%20%20%20%20%20%20%20%20%20%20Engineering&lab=Hydraulics%20and%20Fluid%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20%20Mechanics%20Lab	To determine the coefficient of contractio velocity and discharge of an orifice.
6	https://eerc03-iiith.vlabs.ac.in/exp13/Procedure.html?domain=Civil%20Engineering&lab=Fluid%20Mechanics%20Lab	To draw the constant head; constant-speed and constant efficiency curves of Pelton turbine. principle, work done by the impelle performance curves, Cavitation inpu ps-Reciprocating pump – working princip

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

SEC-WS-301/21 WORKSHOP–III

B.Tech- III Semester (Mechanical Engineering)

No. of Credits: 2				Sessional:	30 Marks
L	T	P	Total	Practical:	70 Marks
0	0	4	4	Total:	100 Marks
				Duration of Exam:	3 Hours

Pre-requisite: Workshop-I, Workshop- II

Successive: Workshop-IV, Workshop-V, Workshop-VI, Workshop-VII

Course Objectives: The objective of studying this course is to understand different mechanical aspects by introduction of conventional machines, welding processes, refrigeration & air conditioning system.

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

CO 1- Learn and understand distinctive functions of conventional machines, arc & gas welding processes and MIG/MAG welding techniques.

CO 2- Perform different exercises on lathe and milling machines.

CO 3- Understand the fundamental concept of refrigeration & air conditioning equipments/systems.

CO 4- Deposit continuous bead in flat position by different welding techniques.

List of Exercises:

Section (A): Machine shop

1. To understand and demonstrate the working principle of various conventional machines namely lathe, milling, shaping & grinding machine.
2. To study elements and angles of single point cutting tools and multiple point cutting tools.
3. To prepare a job involving centering, facing, plain turning and step turning.
4. To prepare a job by machining on milling/ shaper machine and surface grinding on surface grinder.

Section (B): Welding shop

5. To prepare straight continuous bead on a mild steel plate by arc welding using different current setting in flat position.
6. To prepare straight continuous bead on mild steel plate by MIG/MAG welding in flat position.
7. To set oxy-acetylene flames and fusion run without filler rod in flat position by gas welding process.
8. To prepare butt joint on mild steel plate in flat position by arc welding process.

Section (C): Refrigeration & Air conditioning shop:

9. To study various codes and tools used in refrigeration and air conditioning system.
10. To study and calculate the C.O.P of refrigeration cycle.
11. To study different refrigerants& identify various Psychometric properties used in refrigeration & air conditioning system.
12. To perform cutting, flaring, swaging and brazing operations on ferrous and non ferrous tubes.

Note: - Total nine exercises should be performed from the above list. At least two from each section and 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-ME-401/21 APPLIED THERMODYNAMICS

B. Tech (Mechanical Engineering) IV Semester

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

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

Pre- Requisite: Thermodynamics

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

Course Objectives:

The objective of this course is to gain a comprehensive knowledge of various cycles, gas dynamics, nozzles, turbines and heating values of fuel.

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

CO1- Calculate heating values of fuels and analyze various power cycles.

CO 2- Evaluate energy conversion in steam turbines and condensers.

CO 3- Analyze phenomena occurring in compressible flows.

CO 4- Assess the performance of reciprocating compressors.

Course Contents:

Unit 1

Combustion and Steam Boilers: Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis , comparison between fire and water tube boilers, Essentials of a good boiler. Constructional and operational details Cochran and Babcock and Wilcox Boiler. Study of high pressure boilers- Benson, Lamont, Loeffler and Velox boilers, Boiler mountings and accessories, Boiler performance, Natural & Artificial drafts, Chimney height, Maximum draft and chimney efficiency, Boiler heat balance sheet, Numerical Problems. **(8)**

Unit 2

Vapour Power Cycles: Carnot and Rankine vapour cycles, effect of operating conditions on thermal efficiency of Rankine cycle, Rankine cycle with superheat, reheat and regeneration, Supercritical and ultra super-critical Rankine cycle, Binary vapour cycle, Numerical Problems. **(9)**

Unit 3

Flow Through Nozzles: Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow, design pressure ratio, Numerical Problems. **(8)**

Unit 4

Steam Turbines: Classification, Impulse Turbine- Flow through blades, velocity diagram, power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine. Reaction Turbine, Flow through impulse reaction blades, degree of reaction, velocity diagram, power output, efficiency and blade height, comparison of impulse and impulse reaction turbines. Losses in steam turbines, stage efficiency, overall efficiency and reheat factor. Governing of steam turbines, Numerical Problems. **(9)**

Unit 5

Steam Condensers: Elements of a condensing plant, types of condensers, comparison of jet and surface condensers. Condenser vacuum, sources of air leakage & its disadvantages, vacuum efficiency and condenser efficiency, cooling towers, Numerical Problems. **(7)**

Unit 6

Air Compressors: Working of a single stage reciprocating air compressor; calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor with Inter-cooling; Perfect Inter cooling; Optimum intercooler pressure. Numerical Problems. **(9)**

Recommended/ Reference Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., , Fundamentals of Thermodynamics, John Wiley and Sons.

2. Jones, J. B. and Duggan, R. E., Engineering Thermodynamics, Prentice-Hall of India

3. Moran, M. J. and Shapiro, H. N., Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

4. Nag, P.K, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

Web Links:

S.No.	Address of web source	Content
1	NPTELnptel.ac.in	Whole syllabus of Applied Thermodynamics
2	https://youtu.be/jQepo3O4IN8 › courses	Thermodynamics

PCC-ME-402/21 MATERIALS ENGINEERING

B. Tech. (Mechanical Engineering) IV Semester

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

Pre-requisites: Basic Sciences, Mathematics

Successive: Advanced Strength of Materials, Design of Machine Elements, Welding Technology, Metallurgy

Course Objectives:

The objective of studying this course is to develop understanding of crystallography, crystal defects and behavior of alloys under different mechanical/ thermal conditions. The course also addresses the environmental and societal issues related to use of various materials.

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

CO 1- Understand the concept of crystallography and crystal defects.

CO 2- Comprehend the deformation and strengthening mechanism in materials.

CO 3- Describe various fracture modes, mechanisms and factors associated with them.

CO 4- Interpret development of phases in ferrous and non-ferrous alloys by using equilibrium phase diagrams.

CO 5- Identify suitable heat-treatment process to achieve desired properties in steels based on the knowledge of phase transformations.

CO 6- Apply their knowledge about the properties and application of advanced engineering materials keeping in view their economic, environmental and societal impact.

Course Contents:

Unit 1

Crystallography and Associated Defects: Introduction to Materials Science and Engineering, Basic concepts of Crystals, Unit Cells, Crystal Systems, Point Coordinates, Crystallographic Directions, Crystallographic Planes, Density Computations, Linear and Planar Densities, Single Crystals and Polycrystalline Materials, Polymorphism and Allotropy, Anisotropy, Non-crystalline solids, Imperfections in Solids, Point Defects, Dislocations, Interfacial Defects, Bulk or Volume Defects**. (6)**

Unit 2

Deformation and Strengthening Mechanisms in Alloys: Basic Concepts, Characteristics of Dislocations, Slip Systems, Slip in Single Crystals and CRSS, Plastic Deformation of Polycrystalline Materials, Deformation by Twinning, Strengthening of alloys by grain size reduction, solid solution strengthening and strain hardening. **(6)**

Unit 3

Fracture in Alloys: Fundamentals of Fracture, Failure vs. Fracture, Ductile Fracture, Brittle Fracture, Principles of Fracture Mechanics, Stress concentration, Fracture toughness, Fatigue, Cyclic Stresses, The S–N Curve, Crack Initiation and Propagation, Factors that affect Fatigue Life, Environmental Effects, Creep in alloys, Generalized Creep Behaviour, Stress and Temperature Effects on creep. **(6)**

Unit 4

Phase Diagrams: Introduction, Solubility Limit, Solid Solutions, Phases, Microstructure, Phase Equilibria, One-Component (or Unary) Phase Diagrams, Binary Isomorphous Systems, Interpretation of Phase Diagrams, The Gibbs Phase Rule, Tie Line Rule and Lever Rule, Development of Microstructure in Isomorphous and Binary Eutectic Alloys, Invariant Reactions, The Iron–Iron Carbide (Fe–Fe_3C) Phase Diagram, Development of Microstructure in Iron–Carbon Alloys. **(7)**

Unit 5

Phase Transformations and Heat Treatment of Steels: Introduction, Isothermal Transformation Diagrams, Continuous Cooling Transformation Diagrams, Mechanical behaviour of Iron- carbon alloys during phase transformation, Introduction to Heat treatment of Metals, Methods of Annealing, Hardening and Tempering of Steels.**(6)**

Unit 6

Advanced Engineering Materials: Types and applications of Ceramics, Particle Reinforced Composites, Fiber-Reinforced Composites, Introduction to Nano-materials, Shape-Memory Alloys, Bio-materials, Recyclable polymers and Biodegradable Polymers, Economic, Environmental, and Societal Issues in Materials Engineering, Introduction to RoHS directives **(7)**

Recommended/ Reference Books:

1. Material Science and Engineering-An Introduction: Callister, W.D., John Wiley & Sons, Delhi.
2. Elements of Material Science and Engineering: Lawrence H. Van Vlack, Pearson Education India.
3. Introduction to Engineering Materials: B. K. Agarwal, Tata McGraw-Hill Education, India
4. Material Science - Narula, Narula and Gupta. Tata McGraw-Hill Education, India
5. The Essence of Materials for Engineers Robert W., Jr. Messler - Jones and Bartlett Publishers, Inc., USA
6. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi
7. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi

Web links:

S. No.	Weblinks	Modes
1	https://nptel.ac.in/courses/113/102/113102080/	Video lectures
2	https://nptel.ac.in/courses/122/102/122102008/	Video lectures
3	https://nptel.ac.in/courses/113/104/113104014/	Video lectures
4	https://nptel.ac.in/courses/112/108/112108150/	.pdf Notes

PCC-ME-403/21 KINEMATICS OF MACHINES

B.Tech (Mechanical Engineering) IV Semester

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

Pre- Requisite: Engineering Mechanics

Successive: Dynamics of Machines, Design of Machine Elements-I, Design of Machine Elements-II

Course Objectives:

The objective of studying this course is to develop the concept of geometric aspects of motion and its profile in various machine members.

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

CO 1- Describe the concepts of machines, mechanisms and related terminologies.

CO 2- Analyze planar mechanism for displacement, velocity and acceleration graphically

CO 3- Understand the Synthesis of Mechanisms.

CO 4- Analyze various motion transmission elements like gears, gear trains.

CO 5- Develop the geometry of CAM profiles.

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

Course Contents:

Unit 1

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. **(6)**

Unit 2

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. (6)

Unit 3

Synthesis of Mechanisms: Kinematics synthesis of Mechanisms, Type, number and dimensional synthesis, function generation, path generation and body guidance, Two and three position synthesis of four bar and slider crank mechanisms by graphical methods, Freudenstein's equation, precision

positions, structural error; Motion Software, Chebychev spacing, transmission angle, Numerical Problems. **(6)**

Unit 4

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, Bevel gear, Gear Trains**:** Types of gear trains: simple gear train, compound gear train, Reverted gear train, Epicyclic gear train. **(8)**

Unit 5

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. **(8)**

Unit 6

Brakes and Dynamometers: Types of brake: Simple shoe brake, Band Brake, Band and Block brake, Internal expanding shoe brake, Hydraulic & Magnetic Brakes, Dynamometer, Absorption Dynamometer: Prony brake dynamometer, Transmission Dynamometer: Epi-cyclic train dynamometer. **(6)**

Recommended/ Reference 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.

Web Links:

S.N.	Description	Contents
1.	, www.cs.cmu.edu › ~rapidproto › mechanisms › chpt2	Mechanisms and Simple Machines, Gear and Gear Trains
2.	*nptel.ac.in* › courses	*Theory Of Mechanisms - NPTEL*
3.	*mechdesigner.support* › md-cams-mechanisms-mechdes.	Cam Mechanisms - MechDesigner
4.	*me-mechanicalengineering.com* ›	Dynamometer

PCC-ME-404/21 STRENGTH OF MATERIALS-II

B. Tech (Mechanical Engineering) IV Semester

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

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

Pre- Requisite: Engineering Mechanics, Strength of Materials-I

Successive: Design of Machine Elements-I, Design of Machine Elements-II, Modeling, Simulation & Optimization

Course Objectives:

The objective of this course is to present the mathematecal and physical principles for understanding the linear continuum behavious of solids.

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

CO 1- Understand the deformation behavior of solids under different types of loading and obtain mathematical solutions for simple geometries.

CO 2-Evaluate the behaviour and strength of structural elements subjected to three dimensional stress system.

CO 3- Apply and use energy methods to find force, stress and displacement in simple structures.

CO 4- Predict behaviour of materials by using various theories of failures.

CO 5- Calculate the stresses in rotating rings, discs, and curved beams.

Course Contents:

Unit 1

StressTensors: Introduction to Cartesian tensors, Strains: Concept of strain, derivation of small strain te nsor and compatibility, principal strain and directions, strain invariants, problems. Stress: Derivation of Cauchy relations and differential equations of equilibrium and symmetry equations, principal stresses and directions, stress in variants, Constitutive equations, Generalized Hooke's law, stress- strain relations for Isotropic material, Numerical Problems.

Unit 2

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

Unit 3

Energy Methods: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually (ii) suddenly and (iii) with Impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection. Numerical Problems.

Unit 4

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

Unit 5

Rotating Rings & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in rotating cylinders, hollow cylinders & solids cylinders. Numerical Problems.

Unit 6

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

Recommended/ Reference Books:

1. G. T. Mase, R. E. Smelser and G. E. Mase, Continuum Mechanics for Engineers, CRC Press.
2. Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International.
3. Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall International.
4. LS SARINATH:Advanced mechanics of solids, McGraw Hill
5. Strength of Material by Sadhu Singh, Khanna Publisher.

Weblinks:

1. https://nptel.ac.in/courses/112/107/112107146/
2. https://www.youtube.com/watch?v=sP34uzn7diA
3. https://www.youtube.com/watch?v=9Mm5YJkma-0
4. https://www.youtube.com/watch?v=IQB0bJRCRxo
5. https://www.youtube.com/watch?v=CnONQoxubLw
6. https://www.youtube.com/watch?v=zET8EKFnHFE

PCC-ME-405/21 MANUFACTURING PROCESSES
B.Tech (Mechanical Engineering) IV Semester

No. of Credits: 3
LT 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:

The objective of studying this course is to get an insight of the various processes which change the shape, size and form of the raw materials into the desirable products by conventional methods.

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

CO 1- Describe and classify different sand moulding and metal casting processes.

CO 2- Analyze the plastic deformation of metals in metal forming.

CO 3- Describe different machine tools and their machining processes.

CO4- Analyze the mechanics of chip formation and to identify the factors related to tool wear, machinability and cutting tool materials.

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

Course Contents:

Unit 1

Casting and Moulding: Brief introduction to the classification of different manufacturing processes; Introduction to sand mold making procedure and related terminology; Patterns: Pattern Materials, Allowances, Types of pattern; Classification of moulding processes; Sand moulding: Composition, Properties, Types of moulding sands; Brief description of various casting and moulding processes: Permanent mould casting, Die casting, Centrifugal casting, Shell moulding, Precision investment casting, Continuous casting; Gating system: Design, types of gates and risers, Directional solidification; Casting defects and their remedies. **(9)**

Unit 2

Metal Forming: Fundamentals of hot and cold working processes; Plastic deformation and yield criteria; Load estimation for bulk forming (Forging, Rolling, Extrusion, Drawing) **(6)**

Unit 3

Machine Tools: Introduction to machine tools; Cutting speed, feed and depth of cut, Introduction to principle of working, types and operations of common machine tools like Lathe, Milling Machine, Shaper and Drilling Machine.

Cutting fluids: functions of cutting fluids, requirement of good cutting fluids, Types of cutting fluids. **(5)**

Unit 4

Metal Cutting: Single and multi-point cutting; Orthogonal cutting system, Tool signature; Chip formation; Various force components: Merchant circle, Velocity relationships; Tool wear and tool life, Economics of metal cutting, Machinability and machinability index, Numerical Problems.

Cutting tool materials: requirement of cutting tool material, classification of tool material. **(9)**

Unit 5

Gear Manufacturing and Finishing Operations: Different gear manufacturing methods, gear hobbing, gear shaping, gear forming, gear finishing methods.

Finishing processes: Brief description of various finishing processes like: Honning, Lapping and Buffing. **(5)**

Unit 6:

Welding and Allied Processes: Introduction, Classification of welding processes, Gas Welding: Principle, Equipments and flame settings; Resistance Welding: Principle and types; Arc Welding: Principle, Equipments, Arc welding processes: Metal arc welding, Carbon arc welding, TIG, MIG, Submerged arc welding; Brazing and Soldering; Welding defects and their remedies**. (6)**

Recommended/ Reference Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition) Pearson India.

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.

Web Links

S.N	Address of web source	Content
1	https://www.youtube.com/watch?v=ahqqmCfAA3w	Metal casting

2	https://www.youtube.com/watch?v=IGNDMLyx_uE	Casting defects
3	https://www.youtube.com/watch?v=dNbVsmVgOnM	Hot and cold working processes
4.	https://www.youtube.com/watch?v=6cxazvaS6SA	Orthogonal cutting animation
5.	https://www.youtube.com/watch?v=bUrp8JMRwx4	Cutting tool geometry
6	https://www.youtube.com/watch?v=1A2mUdoua5Q	Cutting tool materials
7.	https://www.youtube.com/watch?v=B8w-0Oi0Yf4	Gear manufacturing
8	https://www.youtube.com/watch?v=3b93-8aCeuY&list=TLPQMTIwNzIwMjCshF8TTPuDyA&index=1	Joining process

MCEVS-02 NATIONAL RESOURCES AND BIODIVERSITY CONSERVATION
B.Tech (Mechanical Engineering) IV Semester

No. of Credits: 3
LT P Total
3 0 0 3

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

Pre- Requisite: Nil

Successive: Nil

Course Outcomes (COs): At the completion of this course, the learner will be able to:

CO1- Illustrate types of resources and consequences of resource degradation.

CO2- Appraise the food and land resources and role of individual in conservation of resources.

CO3- Interpret ecological and social phenomena from a biodiversity view point.

CO4- Develop new conservation measures on new or endangered species in a given habitat.

Course Contents:

Unit 1

Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems: **Forest Resources**: Use and Over-exploitation, deforestation. Case studies. Timber exaction 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 using mineral resources, case studies.

Unit 2

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, Soil profile and horizons, Soil formation and degradation, man induced landslides, soil erosion and desertification. Role of and individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit 3

Biodiversity Uses, Threats and Conservation: Introduction- Definition: genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, Social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation.

Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife. man-wildlife conflicts. Endangered and endemic species of India.

Unit 4

Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity, Special Projects for endangered species: Project tiger, Project Gir lion, Project elephant and Project crocodile. Role of WWF, IUCN, UNEP, Red Data Book in restoration of endangered species.

Reference Books:

I. Joshi, B.D., Tripathi, C.P.M and Joshi, P.C. Biodiversity and Environmental Management. APH, New Delhi, 2009.

2. Joshi, P.C. and Joshi, N. Biodiversity and conservation. APH Publishing Co- operation, New Delhi, 2009.

3. Fatik B. Manda! and Nepal C. Nandi. Biodiversity: Concepts, Conservation and Bio.future, Asian Books, 2013.

Suggested Web Sources:

1. http: //cnvisnic.in/l :NVIS html/l_NVISSubjcct/s ubjcct.html

2 https://nptel.ac.in/courses/103/106/103106162/

3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14

4. https://swayam.gov.in/

PCC-ME-406/21 THERMAL LAB-I

B. Tech (Mechanical Engineering) IV Semester

No. of Credits: 1

L T P Total

0 0 2 2

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

Pre- Requisite: Thermodynamics, Applied Thermodynamics

Successive: IC Engines, Air craft Technology, Gas Dynamics and Jet Propulsion.

Course Objectives:

The aim of this course is to familiarize students with the various energy conversion devices and their performance.

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

CO 1- Understand the basic components of a power plant.

CO 2- Describe the various types of boilers and their parts.

CO 3- Explain the working of four stroke and two stroke engines.

CO 4- Conduct performance analysis of I.C. engines.

List of Experiments:

1. To study the function and working of various mountings and accessories in a boiler.
2. To study the construction and working of some low pressure boilers.
3. To study the construction and working of some high pressure boilers.
4. To study the basic elements of a power plant.
5. To study the construction and working of 2 stroke & 4 stroke diesel engine.
6. To study the construction and working of 2 stroke & 4 stroke petrol engine.
7. To prepare heat balance sheet on single/multi-cylinder diesel engine/petrol engine.
8. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) BHP, IHP, FHP vs speed (ii) volumetric efficiency & indicated specific fuel consumption vs speed.
9. Study of Valve Timing Diagram for an I. C. Engine.
10. Study the engine cooling system.

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

PCC-ME-407/21 MATERIALS ENGINEERING LAB

B. Tech (Mechanical Engineering) IV Semester

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

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

Course Objectives:
The objective of the course is to provide hands-on practice on various instruments used to analyze microstructure and properties of materials.

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

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

CO 2- Interpret crystal structures and imperfections in materials.

CO 3- Conduct heat treatment processes on materials.

CO 4- Analyze the microstructure of different materials.

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/ Aluminium specimen.
6. To analyze microstructures of given Grey cast iron specimen.
7. To harden and temper a given steel specimen.
8. To anneal a given hardened steel specimen.
9. 9. To analyze microstructure of quench hardened steel specimen.
10. To determine the properties of plastics.
11. To use digital microscope for Fracture analysis/ measurement.
12. To measure the hardness of a given specimen using microhardeness tester.

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

PCC-ME-408/21 KINEMATICS OF MACHINES LAB
B. Tech (MechanicalEngineering) IV Semester

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

Pre- Requisite: Kinematics of Machines

Successive: Dynamics of Machines

Course Objectives:

The objective of this course is to demonstrate the basic elements of machine members and its arrangement to make a mechanism, such as mechanisms, cam, gears etc.

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

CO 1-Understand the Mechanism and Machine.

CO 2- Discuss the concept of velocity and acceleration

CO3 – Measure application of Friction.

CO 4-Learn the concepts and application of Gears.

CO5- Develop concept of design of CAM

CO6- Understand concept of Dynamometer.

List of Experiments:

1. Kinematics of four bar, slider crank, crank rocker, double crank, double rocker and Oscillating cylinder mechanisms.
2. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
3. To find coefficient of friction between belt and pulley.
4. To generate spur gear involutes tooth profile using simulated gear shaping process.
5. To study various types of gears- Helical, cross helical worm and bevel gear.
6. Estimation of Velocity ratios of simple, compound, epicyclic and differential gear trains
7. To Study Cam profile by using Cam Analyzer.
8. To find out BHP by the help of dynamometers.
9. To fabricate the innovative models based on inversions, Gear trains, Brakes etc.
10. To determine the Coriolis component of acceleration..
11. To determine the Torque by Epicyclic gear train torque measuring machine.

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

Web links:

S.N	Address of web source	Content
1	https://www.youtube.com/watch?v=ahqqmCfAA3w	Metal casting
2	https://www.youtube.com/watch?v=IGNDMLyx_uE	Casting defects
3	https://www.youtube.com/watch?v=dNbVsmVgOnM	Hot and cold working processes
4.	https://www.youtube.com/watch?v=6cxazvaS6SA	Orthogonal cutting animation
5.	https://www.youtube.com/watch?v=bUrp8JMRwx4	Cutting tool geometry
6	https://www.youtube.com/watch?v=1A2mUdoua5Q	Cutting tool materials
7.	https://www.youtube.com/watch?v=B8w-0Oi0Yf4	Gear manufacturing
8	https://www.youtube.com/watch?v=3b93-8aCeuY&list=TLPQMTIwNzIwMjCshF8TTPuDyA&index=1	Joining process

SEC-WS-401/21 WORKSHOP-IV

B. Tech (MechanicalEngineering) IV Semester

No. of credits: 2				Sessional:	30 Marks
L	T	P	Total	Practical:	70 Marks
0	0	4	4	Total:	100 Marks
				Duration of Exam:	3 Hours

Pre-requisite: Workshop-I, Workshop-II, Workshop-III

Successive: Workshop-V, Workshop-VI, Workshop-VII

Course Objectives: To carry out various exercises using conventional machines, welding processes & refrigeration and air conditioning system.

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

CO 1- Perform various operations on lathe, milling, shaper, drilling and grinding machines.

CO 2- Understand the functions and use of various metrological tools and gauges used in machine shop.

CO 3- Prepare various jobs by using arc, gas and MIG /MAG welding processes.

CO 4- Dismantle and assemble compressors used in refrigeration system.

CO 5- Identify different parts , functions of reciprocating and rotary compressors.

List of Exercises:

Section (A) Machine shop:

1. To perform multi operational job (facing, centering, turning, knurling, threading, grooving, chamfering etc) on lathe machine.
2. To understand the use of various metrological tools and gauges namely bore gauge, micrometer (inside and outside), slip gauge, sine bar, snap gauge and plug gauge etc.
3. To perform a job of taper machining/V-shape machining on milling/shaping machine.
4. To prepare a job on surface grinder/cylindrical grinder maintaining dimensions with in close tolerance.

Section (B) Welding shop:

1. To lay weaved bead & prepare T-joint in flat position by arc welding on mild steel plate.
2. To prepare closed butt joint on mild steel plate in flat position by MIG/MAG welding.
3. To perform cutting operation onmild steel plate by oxy-acetylene gas welding.
4. To create fillet weld lap joint on mild steel plate in flat position by arc welding.

Section (C) RAC shop:

1. To carry out dismantling and assembling of single& dual reciprocating compressor.
2. To carry out dismantling and assembling ofrotary open &closed type compressor.
3. To perform gasket cutting for single &dual cylinder, rotary open & close typecompressor.
4. To study and testing of relays, capacitors &troubleshooting of single phase A.C motor.

Note: - Total nine exercises should be performed from the above list. At least two from each section and 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-ME-501/21 HEAT AND MASS TRANSFER

B. Tech (Mechanical Engineering) V Semester

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

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

Pre- Requisite: Thermodynamics

Successive: Internal Combustion Engine, Power Plant Engineering

Course Objectives:
The objective of studying this course is to understand the basic concepts, applications and analysis of heat and mass transfer processes.

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

CO 1- Illustrate different modes of heat transfer.

CO 2- Develop capability for parametric analysis of thermal systems.

CO 3- Analyze the heat transfer devices.

CO 4- Apply numerical methods for the analysis of heat and mass transfer problems.

Course Contents:

Unit 1

Introduction and Modes of Heat Transfer: Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady state one dimensional solution for conduction, heat transfer in Cartesian, cylindrical and spherical geometry, critical insulation thickness, lumped system approximation and Biot number, heat transfer through extended surfaces,one dimensional conduction solutions for unsteady state heat transfer-approximate solution by the use of Heissler charts. Numerical Problems. **(09)**

Unit 2

Heat Convection: Heat convection, basic equations such as continuity equation and momentum equation, introduction to boundary layer, laminar and turbulent flow, external and internal flows (flow over flat plate and circular pipes), 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 flowsituations using appropriate correlations for free and forced convection (flat plate and circular pipes).Numerical Problems. **(08)**

Unit 3

Radiation Heat Transfer: Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Wein's law, Kirchhoff's law, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method, Thermocouple error in temperature measurement. Numerical Problems. **(08)**

Unit 4

Heat Exchanger: Types of heat exchangers, uses of different types of heat exchangers, dimensionless numbers for heat exchanger design, Analysis and design of heat exchangers using both LMTD and ε- NTU methods. Numerical Problems. **(04)**

Unit 5

Mass Transfer: Basic of Boiling and Condensation heat transfer, Pool boiling curve, introduction to heat pipe. Numerical Problems. **(04)**

Unit 6

Numerical Methods in Heat Transfer Analysis: Introduction to numerical methods, Finite difference approximation, Steady state numerical methods. **(03)**

Recommended/ Reference Books:

1. J. P. Holman, Heat Transfer, Tenth Edition, McGraw Hill.
2. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill.
3. D. S. Kumar, Heat and Mass Transfer, S.K.Kataria, Publications.
4. Domkundwar and Arora, Heat and Mass Transfer, Dhanpat Rai & Co.
5. Alan Chapman, Heat Transfer, Pearson.

Web Links:

S.N	Address of web source	Content
1	https://www.youtube.com/watch?v=qa-PQOjS3zA&list=PL5F4F46C1983C6785	NPTEL
2	https://www.youtube.com/watch?v=aLwJKZ1Gf3g&list=PL42D75EB85932E7D3	NPTEL
3	https://www.youtube.com/watch?v=6Zpf3YpkNCM	NPTEL
4	https://www.youtube.com/watch?v=dD8I854RoO8	Work and heat
5	https://www.youtube.com/watch?v=TEJ7Ele0n6Y	NPTEL
6	https://www.youtube.com/watch?v=4bh4efqyzpo&list=PL3zvA_WajfGCwYlesmh4UAl8KtsxXVQYn	NPTEL

PCC-ME-502/21 DYNAMICS OF MACHINES

B.Tech (Mechanical Engineering) V Semester

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

Pre- Requisite: Kinematics of Machines, Engineering Mechanics

Successive: Tribology

Course Objectives:

The objective of studying this course is to analyze the forces and vibrations in the mechanisms.

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

CO 1- Analyze Static and Inertia Forces.

CO 2- Evaluate the Balancing of rotating and reciprocating masses.

CO 3- Describe the working of Mechanical Governor.

CO 4-Determine the Gyroscopic effect.

CO 5- Predict and fix the vibration problems in the machines.

Course Contents:

Unit 1

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. **(9)**

Unit 2

Balancing: Balancing rotating mass in single and several planes, Balancing of reciprocating engine, concept of Partial balancing, Primary and secondary balancing of multi-cylinder inline engine and radial engine, Method of direct and reverse cranks. **(8)**

Unit 3

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. **(8)**

Unit 4

Gyroscopic effect: Spinning and precession, gyroscopic couple, Effect of Gyroscopic couple on the stability of automotive vehicles: Stability of four wheelers & two wheelers. **(6)**

Unit 5

Mechanical Vibrations: Causes of Vibrations, Harmful and useful effects of vibrations, methods of reducing undesirable vibrations, Basic Definitions, Types of Vibrations, Elements of vibrating system, Equivalent stiffness of springs, Equivalent damping coefficient of dampers, methods of vibration analysis, Damped Vibrations, Vibration Isolation, Forced damped vibrations, Whirlings of shafts, Longitudinal vibrations, Transverse Vibrations, Torsional Vibrations. **(9)**

Recommended/ Reference 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.
4. Mechanism and Machines: J S Rao,
5. Mechanical Vibrations :G.K.Grover – Nem Chand & Bros., Roorkee, INDIA

S. N	Address of web source	Content
1	**Mechanical Engineering - Dynamics of Machines - NPTEL** *nptel.ac.in ›*	Whole Syllabus
2	https://youtu.be/AchBiFAEeLo	Centrifugal Governor
3	https://youtu.be/PCOp1AYrDOo	Vibration of Damped SDF system
4	https://youtu.be/YoZgk1xlIW4	Balancing of Single slider mechanism
5	https://youtu.be/HKVvJWArgg8	Rotary Balancing
6	https://youtu.be/XGQr1uEX-Dc	Vibration Measurement

PCC-ME-503/21 DESIGN OF MACHINE ELEMENTS-I

B. Tech (Mechanical Engineering) V Semester

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

Pre-Requisite: Engineering Graphics and Drawing, Materials Engineering, Kinematics of Machines, Strength of Materials-I, Strength of Materials-II

Successive: Design of Machine Elements- II, CAD/CAM

Course Objectives:

The objective of studying this course is to conceptualize the details of material selection, allowable stresses, factor of safety and design of various machine elements.

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

CO 1- Learn the concepts and considerations in machine design.

CO 2- Design different types of mechanical joints and couplings.

CO 3- Design transmission shafts against different loads.

CO 4-. Design of different types of springs and clutches.

Course Contents:

Unit 1

Principles of Mechanical Design: General considerations, Ergonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining, Procedure of design of machine elements, Engineering materials and 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. **(6)**

Unit 2

Mechanical Joints: Design of riveted and welding joints under different static load conditions, Design of screwed joints against static and eccentric loading, Design of cotter joints and knuckle joint. **(14)**

Unit 3

Keys & Couplings: Design of different type of keys; sunk key, saddle key, tangent key, round key and splines, Design of different shaft couplings against torque; Rigid & Flexible couplings. **(8)**

Unit 4

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. **(6)**

Unit 5

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 and design of leaf springs. **(8)**

Unit 6

Clutches & Brakes: Various types of clutches, Design of friction clutches; Single plate clutch, Multi-plate clutch, Cone clutch and Centrifugal clutch, Block Brake with Shoe, Pivoted Block Brake with Shoe, Internal Expanding Brake, Band Brakes, Disk Brakes, Thermal Considerations of Brakes. **(8)**

Recommended/ Reference 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:

S.N	Address of web source	Content
1	https://www.youtube.com/watch?v=mWO_xrzk-vs	Design of Mechanical Joints
2	https://www.slideshare.net/MohamedMohamedElSaye1/keys-and-coupling	Design of Key & Couplings
3	https://nptel.ac.in/content/storage2/courses/112105125/pdf/mod8les1.pdf	Design of Shafts
4	https://nptel.ac.in/content/storage2/courses/112105125/pdf/mod7les1.pdf	Design of Springs
5	https://www.scribd.com/document/282172961/Machine-Design-Design-of-Clutches	Design of Clutches

PCC-ME-504/21 REFRIGERATION & AIR CONDITIONING

B. Tech (Mechanical Engineering) V Semester

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

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

Pre-Requisite: Thermodynamics

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

Course Objectives:

The objective of studying this course is to describe the refrigerants, analyze refrigeration systems & various controls, estimation of the heating & cooling load and design air conditioning systems.

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

CO 1- Classify the refrigerants and analyze the various conventional refrigeration systems.

CO 2- Describe the refrigeration systems other than the conventional refrigeration systems.

CO3- Analyze the different psychometric processes & evaluate cooling and heating loads.

CO 4- Illustrate the different devices used in RAC systems.

Course Contents:

Unit 1

Basic of Refrigeration and Air refrigeration: 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 Refrigerants mixtures: properties and characteristics - Ozone depletion and global warming issues. Air Refrigeration Systems: Brayton refrigeration or the Bell Coleman air refrigeration cycle; Air-craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, comparison of different air refrigeration systems, advantages and disadvantages of air refrigeration cycle, Actual air conditioning system with controls, Numerical Problems **(7)**

Unit 2

Vapour Compression Refrigeration: VC cycle on P-V, T-S and PH diagrams; Effects of operating conditions on COP; Cooling and superheating; Comparison of VC cycle with Air Refrigeration cycle. Super critical vapour compression cycle. Multistage Vapour Compression (VC) Refrigeration Systems: Necessity of compound compression, Compound VC cycle, Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Production of low temperatures: Introduction to Cryogenics, Multistage refrigeration system, Two and three stage cascade systems. Numerical Problems. **(7)**

Unit 3

Other Refrigeration Systems: Vapour Absorption Systems, Practical Ammonia Absorption System, COP of the Absorption System, Lithium Bromide-Water Absorption Refrigeration Systems and Electrolux Refrigeration system, Solar energy (Solar Concentrator) based absorption refrigeration systems, Vapour jet, thermoelectric and Vortex tube refrigeration, Relative merits and demerits, Applications. **(5)**

Unit 4

Psychometric & Air Conditioning Processes: Properties of moist Air, Gibbs Dalton law, Specific humidity, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp, Psychometric chart; Psychometric of air-conditioning processes, Psychometric processes in air washer, Numerical Problems. **(5)**

Unit 5

Heating and cooling load calculation for HVAC system design: Outside and inside design conditions; Sources of cooling load and heating load, Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, Heat generation inside conditioned space; Comfort and industrial air conditioning, Load calculations and Heat pumps, Numerical Problems**. (6)**

Unit 6

Equipment selection for HVAC system: Air distribution system; Basic of Duct systems design; 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. **(6)**

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

Web Links:

S.N	Address of web source	Content
1	https://nptel.ac.in/courses/112/105/112105129	Refrigeration and air conditioning concept and design
2	https://www.danfoss.com/en-gb/service-and-support/learning/cooling-learning/	Refrigeration system design and components

PEC-ME-505/21 INDUSTRIAL ENGINEERING
B.Tech (Mechanical Engineering) V Semester

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

Pre- Requisite: Manufacturing Process

Successive: Operations Research

Course Objectives:

The objective of studying this course is to explore the concepts and practices of industrial engineering applicable in industries.

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

CO 1- Discuss production systems, factors affecting productivity and strategies for its improvement

CO 2- Apply various techniques of method study and work measurement.

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

CO 4- Apply sales forecasting and materials management techniques.

CO 5- Employ techniques and strategies for production planning and control of a production system.

Course Contents:

Unit 1

Production system and Productivity: History of Industrial Engineering, Introduction, aim and generalized model of Production systems, Types of production system, Plant location, Plant layout, objectives and types. Productivity, various methods of productivity measurement, Factors effecting productivity, Strategies for improving productivity, Industry 4.0. **(8)**

Unit 2

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, ISO standards, MFCA (material flow cost accounting), Lean manufacturing, Numerical Problems. **(7)**

Unit 3

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. **(6)**

Unit 4

Materials Management : Definition, importance of materials management 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.**(8)**

Unit 5

Forecasting: Importance, Objectives, Forecasting and Prediction, Types, Classification of Forecasting Methods, Forecast Errors, Costs and accuracy of forecasts, Numerical Problems. **(7)**

Unit 6

Production Planning & Control (PPC) : Objectives & variables of PPC, Aggregate planning, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations, Gantt chart, Sequencing - Johnson algorithm for n-Jobs- 2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines, Introduction to quality and Inventory turnover ratio, Numerical Problems **(8).**

Recommended/ Reference Books:

1. Production & Operations Management – Chary, TMH, New Delhi.
2. Modern Production Management – S.S. Buffa, Pub.John Wiley.
3. Industrial Engineering and Production management, M. Mahajan, Dhanpat Rai.
4. Operation Management - Monks, McGraw Hill ISE.
5. Production & Operations Management - Martinich, John Wiely SE.
6. Industrial & Systems Engineering - Turner, Mize, Case, Prentice Hall Pub.
7. Industrial Engineering & Operations Management – SK Sharma, Pub-S. K.Kataria
8. Industrial Engineering – Ravi Shankar, Galgotia Pub.

Web Links:

S.No.	Address of web source	Content
1.	https://www.youtube.com/watch?v=nm9Qv4w_AE0	Unit-1

2.	http://nptel.ac.in/courses/112107142/	Unit-3
3.	https://www.youtube.com/watch?v=0Op01S8-t-E	Unit-4
4.	http://nptel.ac.in/courses/112107143/	Unit-6

PCC-ME-506/21 THERMAL LAB- II

B. Tech(Mechanical Engineering) V Semester

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

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

Course Objective: The objective of this course is to provide practical insights of the Refrigeration & Air conditioning and Heat Transfer concepts.

Pre- Requisite: Refrigeration and Air Conditioning, Heat and Mass Transfer

Successive: Air conditioning Equipment, Design of Thermal Systems

Course outcomes (Cos); At the end of the course, the student shall be able to:

CO 1-Evaluate COP associated with refrigeration systems.

CO 2- Understand basic function of refrigeration components.

CO 3- Evaluate heat transfer coefficients.

CO 4-Understand the concepts of heat transfer.

List of Experiments:

1. To determine the COP and draw P-H & T-S diagram for compression refrigeration system.
2. To study the cut section model of reciprocating and rotary refrigerant compressor.
3. To study the different types of expansion valves.
4. To determine the COP of vapour absorption system.
5. To determine the COP of water cooler.
6. To determine the thermal conductivity of an insulating power.
7. To find the Stefan-Boltzmann constant for thermal radiation.
8. To Plot temperature distribution along the pin fin under naturaland Forced convective conditions and compare with the theoretical temperature distribution along it.
9. To find the effectiveness of the pin fin in forced and free convection.
10. To find overall heat transfer coefficient and effectiveness of a shell &tube heat exchange under parallel and counter flow conditions.
11. To measure the emissivity of the grey body (plate) at a given temperature.

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

PCC-ME-507/21 DYNAMICS OF MACHINES LAB

B. Tech (MechanicalEngineering) V Semester

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

Pre- Requisite: Kinematics of Machines, Dynamics of Machines

Successive: Tribology

Course Objective:

The objective of this course is to demonstrate the effects of various forces in balancing, governing and directing in a mechanism.

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

CO 1- Understand the force Balancing mechanism through Static and Dynamic Balancing

CO 2- Estimate moment of inertia of connecting rod by different methods.

CO 3- Analyze the characteristics of controlling devices.

CO 4- Determine the frequencies of Mechanical Vibration

List of Experiments:

1. To carry out static balancing on balancing machine.
2. To carry out dynamic balancing on balancing machine.
3. To determine the moment of inertia of connecting rod by trifilar suspension pendulum.
4. To determine the moment of inertia of connecting rod by compound pendulum method.
5. To draw performance characteristic curves and determine stability & sensitivity of governors.
6. To Determine gyroscopic couple on Motorized Gyroscope.
7. To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.
8. To determine the frequency of damped force vibration of a spring mass system.
9. To study the un-damped free vibration
10. To study longitudinal vibration of helical spring & to determine frequency or period of vibration (Oscillation).

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

MC-02 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

B. Tech (MechanicalEngineering) V Semester

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

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

भारतीयिवEा◌ासार – 1

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: अ’◌ादशिवEा -४वेद,४उपवेद (आयुवŐद, धनुवŐद,–गzवD◌ेद, ’थापr आिद) ६वेदांग (◌ि◌शH◌ा, कB, ◌ि◌नŜb, fђ◌ाकरण, Ü◌ो◌ितष, छंद) ४उपाङ्ग (ध◌मD◌शा◌, मीमांसा, पुराण, तकD शा◌) Modern Science and Indian Knowledge System– Yoga and Holistic Health care– Case studies–

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

CO1- Understand the Indian traditional knowledge.

CO2- Understand & Recall the Ancient Indian scriptures.

CO3- Correlate Modern Science and Indian Knowledge System.

CO4- Relate Yoga and Holistic Health care along with case study.

Course Contents:

Unit 1

Introduction of Traditional Knowledge: Indian traditional knowledge of social, science, medicines, warfare, judiciary etc.

Unit 2

Ancient Indian scriptures:

Veda--- Meaning, Types of Vedas-- Rig-Veda, Sama-Veda, Yajur-Veda, and Atharva-Veda,;

Upveda---Meaning, types of upveda, Description of each upveda;

Vedang--- Meaning, no. of Vedang, Description of each Vedang;

Updesha: Dharmshastra, Mimans, Puran, Tarkshastra., Important scriptures of scripture of other religions

Unit 3

Modern Science and Indian Knowledge System: Various field of Indian knowledge; Communication, Mathematics, Phonetics, Metaphysics and Philosophy, Life Sciences, Medical Sciences, Cosmology, Military Science etc.

Unit 4

Yoga and Holistic Health care: Introduction, Yogic Concepts of Wellbeing, Relationship between Health and Disease, Maintain wellbeing,Aurveda.

Unit 5

Case study of development of an Aurvedic treatment centre; Patanjali; Development of Yoga as World Yoga Divas; any other case study related to Indian traditions.

Recommended/ Reference Books:

1) V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya,VidyaBhavan, Mumbai.
2) Swami Jitatmanand, Modern Physics and Vedant, Bharatiya VidyaBhavan•
3) Swami Jitatmanand, Holistic Science and Vedant, Bharatiya VidyaBhavan•
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) VidyanidhiPrakashan, Delhi RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi
8) Prakashan, Delhi P B Sharma (English translation), ShodashangHridayan
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.

Web Links:

S.N.	Web Link	Contents
1	Portalvedicheritage.gov.in	Vedic Heritage
2	Encyclopediawww.ancient.eu	The Vedas - Ancient History
3	https://youtu.be/SgR9sdy6y8A	Veda video lecture
4	https://youtu.be/3ODfwJBDgBs	Yoga
5	ics.purdue.edu ›	Ancient India
6	www.ncbi.nlm.nih.gov	Physicians of ancient India

SEC-WS-501/21 WORKSHOP – V

B. Tech (MechanicalEngineering) V Semester

No. of Credits: 2				Sessional:	30 Marks
L	**T**	**P**	**Total**	Practical:	70 Marks
0	0	4	4	Total:	100 Marks
				Duration of Exam:	3 Hours

Pre-requisite: Workshop-I, Workshop-II, Workshop-III, Workshop-IV
Successive: Workshop-VI, Workshop- VII

Course Objectives: To accomplish different operations using conventional &non-conventional machines, welding processes, refrigeration & air conditioning systems.

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

CO-1-Understand the part programming and operations of CNC machines.
CO 2- Perform various operations on lathe and milling machines.
CO 3- Prepare jobs by using metal inert/metal active gas and oxy-acetylene gas welding.
CO 4-Dismantling and assembly of single phase A.C motor assorted relay and capacitor.
CO 5-Study and test various electrical devices to be used in air conditioners and desert Coolers.

List of Exercises:

Section (A): Machine shop

1. To prepare a slot/keyway in a component on milling / shaper machine.
2. To study working principle and operations of broaching machine.
3. To prepare a part program and machine a cylindrical component involving taper turning, facing and threading operation on CNC turning center.
4. To prepare a job on lathe machine including facing, centering, plain turning, taper turning, threading, drilling and chamfering operations.

Section (B): Welding shop

5. To prepare straight continuous bead on mild steel plate corner jointusing manual metal arc welding.
6. To prepare and test lap joint in flat position on mild steel plate by MIG/MAG welding.
7. To perform brazing on copper sheet to copper pipe with copper filler metal/rod by gas welding.
8. To perform brazing on M.S sheet to M.S pipe with brass filler metal/rod by gas welding.

Section (C): RAC shop

9. To determine the overall heat transfer co-efficient in a forced draft counter current cooling tower.
10. Testing and tracking outvarious electrical devices used in room and desert coolers.
11. To calculate the COP and capacities of industrial refrigeration rig and cold storage plant.
12. To study and testing of VRV-III system.

Note: - Total nine exercises should be performed from the above list. At least two from each section and 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. Also, the project based exercise will be performed by the students in their respective shops.

PCC-ME-601/21 CAD/CAM

B.Tech (Mechanical Engineering) VI Semester

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

Pre- Requisite: Engineering Graphics and Drawing, Manufacturing Processes

Successive: Automation in Manufacturing, Flexible manufacturing system

Course Objectives:

The objective of this course is to understand the fundamentals of CAD / CAM and its applications.

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

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

CO 2- Describe elements of advanced manufacturing system.

CO 3- Acquire knowledge about latest technologies used in CAM& CAE

CO 4- Generate different curves, surfaces and solid models for mechanical designs.

Course Contents:

Unit 1

Basics of CAD: Need and Scope of Computer Aided Design, Fundamental of CAD and computer graphics- Application areas, Comparison of CAD with Manual designing, Benefits of CAD, UCS, 3D systems, 2D geometrical transformations, Matrix representations and homogeneous coordinates, composite transformations, transformations between coordinate systems. 2-D viewing, 3-D Geometric transformations, composite transformations, Importance of transformations. **(7)**

Unit 2

Curves and Surfaces: Representation of circle, Arc, Ellipse, parabola and hyperbola. Synthetic Curves**;** Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines and NURBS. Types of surfaces used in automotive industry along with their applications. **(6)**

Unit 3

Solid Modelling: Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations. Schemes: B-rep, CSG, Sweep representation, Primitive instancing, Cell Decomposition Techniques. (**6)**

Unit 4

Computer aided Engineering: Introduction to simulation, Interference detection, failure analysis under static and dynamic loading, Preprocessing, Elements used in CAE, Material defining, Meshing, optimal mesh, loading and constraints, boundary conditions, solvers, post processing and reviewing the results, validation of the CAE results, Case study using ANSYS software. **(6)**

Unit 5

Computer Aided Manufacturing: Introduction & role of NC, CNC & DNC, Advantages, Disadvantages and Applications of NC, Features of CNC system, Features of DNC and adaptive control systems., Safety measures. Flexible Manufacturing System**,** Components of FMS, FMS equipment & control, Automated guided vehicle systems, Automated storage and retrieval system, Computer Integrated Manufacturing; Computer Aided Process Planning**.(8)**

Unit 6:

Latest Technologies: Introduction to Industry 4.0, FEM, Robotics, Reverse engineering and computer aided inspection, cloud manufacturing, artificial intelligence and machine learning. **(7)**

Recommended/ Reference Books:

1. Ibrahim Zeid *CAD/CAM - Theory and practice Tata McGraw Hill* Publishers.

2. Salomon, D. *Transformations and projections in computer graphics* Springer.

3. Rao, P.N., CAD / CAM Principles and Applications, McGraw Hill Publishers, New Delhi.

4. M.P. Groover , Automation, production systems and Computer-integrated Manufacturing,

Eastern Economy Edition.

5. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill Publications.

6. Nanua Singh , System approach to Computer-integrated design and manufacturing, , Wiley India.

7. T. C. Chang, R. A. Wysk and H. P. Wang, Computer Aided Manufacturing, Pearson

Web Links:

S.N	Address of web source	Content
1	http://home.iitk.ac.in/~jrkumar/download/ME761_Lecture-6%20CAD.pdf	CAD Intro & Transformations
2	https://www.slideshare.net/YatinSingh3/curves-67337125	Curves & Surfaces
3	https://www.slideshare.net/ayushupadhyay6/ppt-of-solid-modeling-for-cad	Solid Modeling
4	https://en.wikipedia.org/wiki/Finite_element_method	Finite Element Analysis
5	https://en.wikipedia.org/wiki/Computer-aided_manufacturing	Computer-aided manufacturing
6	https://nptel.ac.in/courses/112/105/112105249/	Robotics

PCC-ME-602/21 MANUFACTURING TECHNOLOGY
B.Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Manufacturing Processes
Successive: Welding Technology, Automation in Manufacturing, Mechatronics, Tool Design

Course Objectives:

The objective of this course is to provide students an insight on conventional and non-conventional methods of manufacturing.

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

CO 1- Understand the working principles of conventional machine tools and holding devices.

CO 2- Discuss the process of powder metallurgy and plastics manufacturing.

CO 3- Classify press tools and design related punches and dies.

CO 4- Describe various metrological tools based on their working principles.

CO 5- Distinguish between working of various non-conventional machining processes.

Course Contents:

Unit 1

Conventional machines tools and Holding devices: Introduction, principle, construction detail of manufacturing machines Boring machine, broaching machine and planer, tool and cutter grinder.

Holding devices: jigs and fixture, locating principles and locating devices, clamping principles and clamping devices, drill bushes, drilling jigs, fixture: turning fixture, milling fixture, grinding fixture **(7)**

Unit 2

Powder metallurgy and Plastic manufacturing: Powder Metallurgy: Introduction, steps of powder metallurgy: powder manufacturing techniques, compacting and sintering, applications of powder metallurgy

Plastics: Types of plastics, Injection moulding, its application, merits and demerits, plastic extrusion. **(6)**

Unit 3

Press Tools and Design of Punch and Die: Introduction, press operations, types of presses, press working terminology, press rating, types of dies, design of die and punch; principles of forging die design. **(7)**

Unit 4

Metrology: Metrology: Dimensions, forms and surface measurements, Limits, fits and tolerances; linear and angular measurements; comparators; gauge: slip gauge, standard gauge, limit Gauge, plug gauge, snap gauge; interferometry; optical flat and interferometer tolerance analysis in manufacturing and assembly. **(8)**

Unit 5

Non-conventional machining methods: Thermal metal removal process:Electrical Discharge Machining: construction detail, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire cut EDM;

Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam principle, application and limitations **(6)**

Unit 6

Non-conventional machining methods: mechanical processes, electrochemical process:Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, and Ultrasonic Machining: process parameters, MRR and surface finish.

Electro-chemical machining (ECM): principle, elements of ECM, advantages, application and limitation.

Chemical machining: principle, etchant & maskents, advantage, application and limitation. **(6)**

Recommended/ Reference 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.
4. Manufacturing Engg. & Tech, Kalpakian, Serope Addison -Wesley Publishing Co. New York.
5. Modern Machining Processes: P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
6. Text Book of Production Engineering: P.C. Sharma, S.Chand & Sons.

Web Links:

S.N.	Address of web source	Content
1	https://youtu.be/YRaQ-BZvApk	PRESS TOOL DEIGN
2	https://www.youtube.com/watch?v=T58PyJraLos	Forging Die design consideration
3.	https://www.youtube.com/watch?v=wLaXCJLQwC	Tolerance analysis-1

	Q&t=559s	
4.	https://www.youtube.com/watch?v=D25F6AmNHfo	Tolerance analysis -2
5.	https://www.youtube.com/watch?v=TkaCddeEZEY	Advance machining process

PCC-ME-603/21 DESIGN OF MACHINE ELEMENTS- II

B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Strength of Materials, Design of Machine Elements- I

Successive: Design and Optimization, Tribology

Course Objectives:

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

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

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

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

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

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

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

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

Course Contents:

Unit 1

Variable Loading: Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems. (6)

Unit 2

Design of Screws and Fasteners: Thread standards and definitions, mechanics of power screws, threaded fasteners, fastener stiffness, Studs, Design of Screw Jack. **(8)**

Unit 3

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**. (8)**

Unit 4

Gears: Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth -Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems. **(8)**

Unit 5

Design of Flywheels: Turning moment diagram, coefficient of fluctuation of energy and speed, design of solid and rimmed flywheel**. (6)**

Unit 6

Design of Miscellaneous Components: C-clamp, Piston, Crank Shaft and Connecting Rods. **(6)**

Recommended/ Reference Books:

1. Mechanical Engineering Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
3. Engineering design – George Dieter, McGraw Hill, New York.
4. Machine Design an Integrated Approach: Robert L.Norton, Second Edition –Addison Wisley Longman.

Web Links:

S.No.	Address of web source	Content
1.	https://drive.google.com/file/d/1eyW-939KoYptng1ofoDYNOFGl3nmZJqE/view?usp=sharing	Flywheels- Lecture-1
2.	https://drive.google.com/file/d/1-CJfDRq-BQpAueAZg6ANQNiKS2Q07zkB/view?usp=sharing	Flywheels- Lecture-2
3.	https://drive.google.com/file/d/1-5Ukrz9REOcPwMyn8U15te33WxLTeDCl/view?usp=sharing	Gears- Lecture- 1
4.	https://drive.google.com/file/d/1QsfvEw5j6qJciYPMcjalO9TMtYTvkEhe/view?usp=sharing	Gears- Lecture- 2

5.	https://drive.google.com/file/d/1P68BFoRXu4QQnu3xgzmKPdDYqonHyeZd/view?usp=sharing	Gears- Lecture- 3

MCEVS-03 ENVIRONMENT POLLUTION, WASTE MANAGEMENT AND SANITATION
B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Nil

Successive: Nil

Course Outcomes (COs): At completion of this course, the learner will be able to:

CO1- Acquire the knowledge of sources, effects and control measures for environmental pollution/climate change at local and global level.

CO2- Gain insight into disaster management, environmental legislation and impact assessment.

CO3- Understand various concepts related to solid waste management and apply in solid waste management.

CO4- Analyze health and sanitation problems in the living environment and understand various social issues related to environment.

Course Contents:

Unit 1

Environmental Pollution and Climate Change: Definition - Causes: effects and control measure~ of: - Air Pollution, Water pollution, Soil Pollution, Marine pollution, Noise pollution, Thermal Pollution, Nuclear Hazards. Role of an individual in prevention of pollution. Case studies.

Climate Change: Causes, Consequences and Solution of Climate Change and its effect on: Agriculture, Availability of Fresh Water and Change of River Ecosystem, Sea-Level Rising and Loss of Human interest. IPCC Agenda 21, Earth Summit, Stockholm Conference 1972. Convention on Biological Diversity (CBD), Ramsar Convention. Kyoto Protocol, Montreal Protocol.

Unit 2

Disaster Management: Floods, Drought, Earthquake, Volcanoes, Cyclone and Landslides - their impacts. Disaster management cycle. Role of information, education communication and training in disaster management.

Environmental Legislation and EIA: Role of Ministry of Environment and Forest (MoEF), Government of India; Central Pollution Control Board (CPCB); National Environmental Policy (NEP) -2006, in developing legislation. 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. Environmental

Awareness: Role of Non-Government Organizations in Public Awareness. **Environment Impact Assessmcnt**: Concept and significance: methods of assessment.

Unit 3

Waste Management: Introduction to Solid waste management: Primary waste products - Solid waste, Toxic biological and hospital wastes; Waste composition and characterization. Municipal solid waste generation, cycling and disposal: landfills, incineration, source reduction and recycling, Hazardous waste management and handling rules.

Unit 4

Environmental Sanitation and Health: Introduction to WHO and UNICEF, water and airborne diseases: TB, Cholera. Amoebiasis, and Dehydration: ORT, social economic and health impacts of AIDS. Role of public awareness and information technology in sanitation and human health.

Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, Rainwater Harvesting, Watershed management, Resettlement and rehabilitation of peoples; its problems and concerns, case studies. Environmental ethics: Issues and possible solutions. Environmental Education. Waste land reclamation, Consumerism and Waste products. Environmental movements: Chipko Movement.

Reference Books:

1. Solid Waste Management Manual CPCB, New Delhi .
2. Trivedy R.K. and Arvind Kumar, Eco technology for Pollution Control and Environmental Management
3. Sahai, Sushma (2009) Bio- medical waste management, APH Publishing.
4. Rao, M.N. and Sultana, R. (2012). Solid and Hazardous Waste Management, BS Publications, Hyderabad.
5. Canter, W. L. (I 995) Environmental Impact Assessment, McGraw-Hill Science/ Engineering/ Math, New York
6. Kulkarni, V. and Ramachandra, T.V. Environmental Management. Capital Pub. Co, New Delhi. 2006.
7. Glasson, J. Therivel, R. and Chadwick, A. Introduction to Environmental Impact Assessment. Routledge, London. 2006.
8. Sushmitha Bhaskar and R. Bhaskar, Natural Disasters, Unicorn Books, 2011.
9. Bohle, H. G., Downing, T. E. and Watts, M. J. Climate change and social vulnerability: the sociology and geography of food insecurity, Global Environmental Change. No.4, pp. 37-48.

I0. Kuka!, S. S., Kingra, P. K. (2019). Introduction to Environmental and Disaster Management, Kalyani Publishers.

11 .Kudrow, N. J. (2009). Conservation of Natural Resources. Nova Science Publishers, Incorporated

12. Anderson, D. A. (2013). Environmental economics and natural resource management. Routledge.

Suggested Web Sources:

1. http: //cnvisnic.in/l :NVIS html/l_NVISSubjcct/s ubjcct.html

2 https://nptel.ac.in/courses/103/106/103106162/

3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14

4. https://swayam.gov.in/

PCC-ME-604/21 CAD/CAM LAB

B.Tech (Mechanical Engineering) VI Semester

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

Pre- Requisite: Engineering Drawing

Successive: Design and Optimization

Course Objectives:

The objective of this course is to understand the practical aspects of CAD, CAE and CAM tools for Design and optimization.

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

CO 1- Learn the techniques of 2D and 3D modelling using CAD software.

CO 2- Design surface and solid models using CAD software.

CO 3- Prepare jobs using CNC turning and machining centres.

CO 4- Inspect jobs using CMM and learn basics of robotics.

List of Experiments:

1. Introduction to CAD softwares and working with sketcher tools.
2. To generate 2D models using CAD software.
3. To generate 3D models using CAD software using commands; Round, Chamfer, Fillet, Pattern, Copy, Rotate, Move and Mirror.
4. Working with advanced modeling tools (Sweep, Blend, Variable section Sweep, Swept Blend & Helical Sweep).
5. Assembly modeling, Generating, editing and modifying drawings in CATIA/ Solidworks/ ProE.
6. CAE of the cantilever beam with concentrated load and UDL.
7. To perform facing and taper turning operations using CNC turning centre.
8. To perform milling and hole making operations using CNC machining centre.
9. To measure the dimension of prismatic component using CMM.
10. To measure the dimension of cylindrical component using CMM.
11. To perform welding/pick-place/drawing operation using robotic assembly.

Note: At least ten experiments are to be performed in the semester. Eight experiments are to be performed from the above list and the rest may be designed/ conducted by the concerned department/institution.

MC-04G MESSAGE OF BHAGAVAD GITA

B.Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: NIL
Successive: NIL

Course Objectives: To enable the students to create an awareness on message of Bhagawad Gita. To instill moral, social values and to appreciate the Karma Yoga.

Course Outcomes (COs): After completing this course the **s**tudent should be able to:
CO1- Realize the relevance of Bhagavad Gita today.
CO2- Relate Yoga to Devotion
CO3-Realize the duties and Responsibilities in the Society.

Course Contents:

Unit1

Introduction: Relevance of Bhagavad Gita Today- Background of Mahabharata.Arjuna Vishada Yoga: Arjuna's Anguish and Confusion- Symbolism of Arjuna's Chariot.Sankhya Yoga: Importance of Self- knowledge- Deathlessness: Indestructibility of Counciousness- Being Established in Wisdom- Qualities of Sthita- Prajna.

Unit 2

Karma Yoga: Yoga of Action- Living in the Present- Dedicated Action without Anxiety over Results- Concept of Swadharma.

Dhyana Yoga: Tuning the Mind- Quantity, Quality and Direction of Thoughts- Reaching Inner Silence.

Unit 3

Bhakti Yoga: Yoga of Devotion- Form and Formless Aspects of the Divine- Inner Qualities of a True Devotee

Gunatraya Vibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattava- Going Beyond the Three Gunas- Description of the Gunatheetha.

Recommended/ Reference Books:

1. Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust.
2. Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust.

SEC-WS-601/21 WORKSHOP- VI

B.Tech (Mechanical Engineering) VI Semester

No. of credits:2				Sessional:	30 Marks
L	T	P	Total	Practical:	70 Marks
0	0	4	4	Total:	100 Marks
				Duration of Exam:	3 Hours

Pre-requisite: Workshop-I, Workshop-II, Workshop-III, Workshop-IV, Workshop-V
Successive: Workshop-VII

Course Objectives: To perform various operations on milling, shaper, drilling and CNC machine center and test weld beads at different positions in arc welding process.

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

CO1-Cut gears on a work piece by gear hobbing /gear shaper.
CO2-Create various jobs on conventional lathe, milling/shaper and CNC turning center.
CO3-Prepare various jobs by Arc, MIG/MAG, TIG and gas welding techniques.
CO4-Learn troubleshooting of all metering devices, testing of leakage and electrical wiring of coolers, deep freezers and air conditioners.

List of Exercises:

Section (A): Machine shop

1. To prepare a job consisting of drilling, tapping, recessing and chamfering operations on milling/shaper and drilling machine.
2. To prepare single point brazed tool with carbide tip on a mild steel shank involving milling and brazing operations.
3. To machine round hole on broaching machine.
4. To perform gear cutting operation by gear hobbing/gear shaper.
5. To prepare the part program and machine a prismatic component involving face milling, end milling and hole making operations on CNC machining center.

Section (B): Welding shop

6. To prepare and test* straight continuous bead in upward and downward direction in vertical position on M.S. plate by arc welding.
7. To prepare T-fillet joint in flat positionon mild steel plate by MIG/MAG welding.
8. To prepare straight continuous bead on stainless steel/aluminum sheet by TIG welding.
9. To prepare straight continuous bead on stainless steel using M.S electrode by manual metal arc welding

Section (C): RAC shop

10. To study humidification and dehumidification process used in refrigeration system.
11. To study different types of metering devices and to carry out electrical wiring of refrigerator, coolers and deep freezers.
12. To identifythe leakage ofrefrigeration system.
13. To test, repair and maintenance of window and split type air conditioning system.

Note: -Total nine exercises should be performed from the above list. At least two from each section and 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. The project based exercise will be performed by the students in machine shop, welding shop and refrigeration and air conditioning shop.

PCC-ME-701/21 AUTOMATION IN MANUFACTURING
B.Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: CAD/CAM, Manufacturing Processes, Manufacturing Technology

Successive: Nil

Course Objectives:
The objective of this course is to get familiar with automation concepts in advanced manufacturing system.

Course Outcomes: At the end of the course, the student shall be able to:
CO1- Understand various types of automation and their elements.
CO2- Acquire knowledge about Industry 4.0 and IoT.
CO3- Select and analyze various materials handling equipments in manufacturing systems.
CO4- Acquire knowledge of artificial intelligence and its applications.

Course Contents:

Unit 1

Introduction to Automation: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity. **(6)**

Unit 2

Introduction to Industry 4.0 and its components: features, working, advantages and applications, Programmable logic controllers and its working and programming IoT, its basic components and its role in automation. **(7)**

Unit 3

Overview of Material Handling Systems: Rotary feeders, oscillating force feeder, vibratory feeder, elevator type and Centrifugal type feeders, Principles and Design Consideration, Material Transport Systems, Storage Systems. **(7)**

Unit 4

Automated Manufacturing devices: Components, Classification and Overview of pneumatic and hydraulic systems. Actuators, Valves and Electric Control devices. **(7)**

Unit 5

Sensors and Controllers: Industrial Control Systems, Process Industries Verses Discrete - Manufacturing, Industries Continuous Verses Discrete Control, Computer Control Process and its Forms. Sensors Actuators and other Control System Components. **(7)**

Unit 6

Artificial intelligence and applications: Introduction, Need for Machine Learning, Tools and Applications of AI in mechanical engineering, Comparison analysis of results using AI, robots and application of AI in robotics. Case studies on use of AI using research papers.**(6)**

Recommended/ Reference Books:

1. Mikell P. Groover, Automation, Production Systems, and Computer - integrated Manufacturing, prentice Hall
2. SeropeKalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson
3. Mechatronics by W. Bolton
4. Hydraulics and Pneumatics by Jagdeesha T, I.K. International Publishing House Pvt Ltd.

Web Links:

S.N	Address of web source	Content
1	www.youtube.com	all
2	www.nptel.com	all

PCC-ME-702/21 OPERATIONS RESEARCH
B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Industrial Engineering

Successive: Nil

Course Objectives:

The objective of this course is to develop decision making capabilities of the students by analyzing different situations within an environment involving limited resources and constraints thereby finding the optimal solution.

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

CO 1-Understand the role of operations research in decision-making, and its applications in industry.

CO 2-Apply linear programming technique and perform sensitivity analysis.

CO 3-Learn various types of deterministic models and their applications.

CO 4-Illustrate the concept of project line models with examples.

CO 5-Apply simulation models in decision making environment.

Course Contents:

Unit 1

Introduction: Definition, role of operations research in decision-making, applications in industry. Concept on O.R. model building –Types & methods. **(4)**

Unit 2

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. **(8)**

Unit 3

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepping stone method, MODI methods, degeneracy, assignment, travelling salesman, problems. **(8)**

Unit 4

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems. **(6)**

Unit 5

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 levelling in project, problems. **(8)**

Unit 6:

Simulation and Decision Theory: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, Decision process, SIMON model, types of decision making environment - certainty, risk, uncertainty, decision making with utilities, problems. **(6)**

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

Recommended/ Reference Books:

1. Operations Research – Hamdy A. Taha, Pearson Education.

2. Quantitative Techniques in Management – N.D. Vohra, TMH, New Delhi

3. Operations Research – J.K. Sharma, Trinity Press

4. Operations Research – Ravindran, Phillips, Solberg, Wiley Student Edition.

5. Principles of Operation Research – H.M. Wagner, Prentice Hall of India, New Delhi.

6. Introductory Operations Research – H.S. Kasana, K.D. Kumar, Springer

Web Links:

S.No.	Address of web source	Content
1.	http://nptel.ac.in/courses/112106134/	Unit 2 and 3
2.	http://nptel.ac.in/courses/112106131/	Unit 4 and 5

SEC-WS-701/21 WORKSHOP – VII

B. Tech (Mechanical Engineering) VII/VIII Semester

No. of credits: 2				Sessional:	30 Marks
L	T	P	Total	Practical:	70 Marks
0	0	4	4	Total:	100 Marks
				Duration of Exam:	3 Hours

Pre-requisite: Workshop-I, Workshop-II, Workshop-III, Workshop-IV, Workshop-V, Workshop-VI
Successive: Nil

Course Objectives: The objective of this course is to perform various operations on lathe, milling and CNC wire cut machine. To carry out welding operations like: arc, MIG, TIG and SAW on different work materials. To find out C.O.P and control temperature of cold storage plant of refrigeration system.

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

CO1- Prepare jobs on lathe and milling machine.
CO2-Develop various jobs using arc, resistance, MIG/MAG and Submerged Arc welding (SAW).
CO3-Understand the fundamentals of refrigeration and air conditioning test rig and cold storage plant.
CO4-Rectify electrical and mechanical faults incurred in window & split type air conditioners.
CO5-Prepare different jobs on CNC wire cut.

List of Exercises:

Section (A): Machine shop

1. To perform eccentric turning on a component using lathe machine.
2. To perform taper cutting and grinding on 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.

Section (B): Welding shop

5. To prepare 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 butt joint on aluminum sheetusing TIG welding.
8. To prepare straight continuous bead on mild steel plate in flat position using different parameters by submerged arc welding.

Section(C): RAC shop

9. To calculate C.O.P and capacities of split air conditioner test rig and room air conditioner
10. To flush out (dehydrate & evacuate) the refrigeration system.
11. To pull down the temperature of cold storage plant to specific temperature.
12. To study and testing of VRV-IV system.

Note: - Total nine exercises should be performed from the above list. At least two from each section and 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. Also, the project based exercise will be performed by the students in their respective shops.

PROFESSIONAL ELECTIVE COURSES

PEC-ME-601/21 VISIONARY LEARNING IN MANUFACTURING (PEC-I)

B. Tech (Mechanical Engineering) VI Semester

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

Pre- Requisite: Manufacturing technology

Successive: Project

Course Objectives:

The objective of this course is to get the students familiarised with observation skill and planning & controlling of manufacturing systems.

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 the concept of Lean manufacturing.

CO 4- Develop V-map and Hie- Junka plan

Course Contents:

Unit 1

Introduction Manufacturing system; SMEs and their characteristics; Challenges of small and Medium Industries, Key performance indicator of business, Introduction to VLCI; Visionary Leadership; Quality of good leadership; Challenges to lead SMEs; Motivation and Attitude, Visual Control. **(8)**

Unit 2

Observation Skill: Cleanliness 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. **(9)**

Unit 3

V-Map: 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. **(10)**

Unit 4

V-map2: Standardise work principle; Productivity improvement; Tree of Productivity; Introduction to V-map 3; steps for drawing V-map3; Cycle time and its calculation; Preparation of SWCT chart, Product Meter and Line meter.**(8).**

Unit 5

Introduction to Hie-Junka planning: Methodology adopted in Hie-Junka, review and control. Concept of ZED (Zero defect Zero effect), Model of Maturity Assessment, Indian Case studies, A comparative study of Indian and Japan's model of quality programme, Understanding of Kaizen, Concept of TPS.**(10)**

Recommended/ Reference Books:

1. Observations skill by : Sharad Anerao, Anand Group

2. Study material Developed by VLCI group

3. A Revolution in Manufacturing: The SMED System: Single-minute Exchange of Die System : shigeo Shingo

4.The Six Sigma Way: How to Maximize the Impact of Your Change and Improvement Efforts : Peter Pande, Robert Neuman, Roland Cavanagh Level - Wiley .

5. Toyota Production System: Beyond Large-Scale Production : Taiichi Ono

Web Links

S. No	Links	Topic covered
1.	https://www.youtube.com/watch?v=mpTD8UANZYk	VLCI
2.	https://www.youtube.com/watch?v=zpJ98WObz7w	Concept of ZED
3.	https://www.youtube.com/watch?v=J4v-HjY3R0Y	Lean Production
4.	https://www.youtube.com/watch?v=c0Q-xaYior0	3S
5.	https://www.youtube.com/watch?v=Z9QbYZh1YXY	Agile system

PEC-ME-602/21 PRODUCT DESIGN AND DEVELOPMENT (PEC-I)
B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Industrial Engineering
Successive: Nil

Course Objectives:

The objective of this course is to study essential concepts of product design and development.

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

CO1-Conceptualise product design and development processes in manufacturing industry.

CO2-Understand the Development process and product planning.

CO3- Apply the Product design methods.

CO4- Carry out cost analysis through various cost models.

CO5- Apply concepts of economics in product design.

Course Contents:

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, Introduction to CAD/CAM. **(5)**

Unit 2

Development process and product planning: Generic development process, Concept development, product development process flows, product planning process, identify customerneeds, Generation of voice of customers. **(6)**

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.**(6)**

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. **(8)**

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.**(8)**

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. **(7)**

Recommended/ Reference 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.

4. George Dietor, A material and Processing approach, McGraw Hill

Web Links:

S.N	Address of web source	Content
1	https://nptel.ac.in/courses/112/107/112107217/	Introduction, New Product development process, Product design, Quality Function deployment (QFD), Value Engineering, Prototyping
2	https://nptel.ac.in/courses/112/104/112104230/	Design for manufacture, assembly, environment, graphics,
3	https://www.youtube.com/watch?v=hGSJJLoHiVQ	Concept generation

PEC-ME-603/21 INTERNAL COMBUSTION ENGINES (PEC-I)

B. Tech (Mechanical Engineering) VI Semester

No. of Credits: 3
LT P Total
3 0 0 3

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

Pre- Requisite: Thermodynamics, Heat Transfer.

Successive: Automobile Engineering, Gas Dynamics and Jet Propulsion

Course Objectives:

To familiarize with functioning of IC engines, its performance analysis.

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

CO 1-Understand basics associated with IC engines.

CO 2-Analysis of combustion in SI and CI engines.

CO 3-Conceptualize the testing of engines.

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

Course Contents:

Unit 1

Introduction

Classification of Internal Combustion Engines, Parts of I.C. Engine and their materials, Air standard Cycles in Four stroke and Two-stroke IC engines and their comparative study, Brayton cycle, parameters related to testing of IC engines, determination of volumetric efficiency and factors affecting volumetric efficiency, Adiabatic flame temperature, Combustion efficiency, Valve Timing Diagram, Low Heat Rejection Engines, Homogeneous charge compression Ignition.**(06)**

Unit 2

Combustion and Ignition System in SI Engines

Spark ignition Engine mixture requirements, Fuel-Air ratio, Simple carburettor, Single-point and Multipoint injection system, Gasoline Direct Injection, Combustion phenomenon in SI Engines, Ignition delay, Flame propagation, Pressure-Crank angle diagram, Abnormal combustion, Auto ignition, Detonation and Knocking, Factors affecting combustion and detonation, Types of combustion chambers, Working principle of stratified charge engines.

Battery Ignition System, Magneto Ignition System, Functions and working of ignition coil, spark plug, contact breaker point, Requirements and working of Ignition advance mechanisms, Electronic Ignition Systems; Capacitor Discharge Ignition System, Transistorized Coil Assisted Ignition System, Transistor Ignition system with contactless breaker. **(09)**

Unit 3

Fuel Injection and Combustion in CI engines

Air injection systems, Airless/solid injection systems, Common rail, individual pump, distributor and unit systems. Injection pumps, Fuel injector, Types of nozzle, Electronically controlled unit fuel injection system. Stages of combustion in CI engines, air fuel ratio, cold starting of CI engine and cold starting aids, delay period or ignition lag, variables effecting delay period, diesel knock, Factors affecting combustion and knocking, methods of controlling diesel knock, Types of CI engine combustion chamber. Need for supercharging, Effect of supercharging, types of supercharger, methods of supercharging, thermodynamic analysis of supercharged engine cycle, limitations of supercharging, turbocharging. **(09)**

Unit 4

Lubrication system and cooling system

Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems– wet sump and dry sump, crankcase ventilation, Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling. **(04)**

Unit 5

Alternative Fuels

Alcohol - Hydrogen - Natural Gas and Liquefied Petroleum Gas – Biodiesel- Biogas - Producer Gas - Properties - Suitability - Engine Modifications - Merits and Demerits as fuels, comparison of their properties with Diesel and petrol, method of manufacturing.**(04)**

Unit 6

Alternative Fuels

Air pollution due to IC engines, Constituents of exhaust emission at its harmful effect on environment and human health, Formation of NOx, HC, CO and particulate emissions, Methods of controlling emissions; Catalytic convertors, particulate traps, Exhaust Gas Recirculation, EURO and BHARAT norms.**(04)**

Recommended/ Reference Books:

1. Obert E. F, "Internal Combustion Engines and Air Pollution", Harper andRow Publication Inc. NY,1973.
2. Willard W. Pulkrabek , "Engineering Fundamentals of the Internal Combustion Engine" PHI 2003.
3. Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989

Web Links:

1. https://www.youtube.com/watch?v=CO2StedJtAc&list=PLwdnzlV3ogoXHbVNKWL1BYOo_8PpyNtnC

2. https://www.youtube.com/watch?v=2iYqZ8tIP1I&list=PLT7nZHsCM2mxVhbXn7BeHTXg4w7btBf5I

PEC-ME-604/21 GAS DYNAMICS AND JET PROPULSION (PEC- I)

B. Tech (Mechanical Engineering) VI Semester

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

Pre- Requisite: Thermodynamics, Applied Thermodynamics

Successive: Aircraft Technology

Course Objectives:

The objective of this course is to familiarize the students about the gas dynamics & jet propulsions and their applications.

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

CO 1- Describe the concepts of compressible flow.

CO 2- Analyze the adiabatic and isothermal flow through constant area duct.

CO 3- Explain the concepts and applications of propulsion systems.

CO 4- Classify wind tunnels.

Course Contents:

Unit 1

Introduction:

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. **(06)**

Unit 2: Fluid Flow Thermodynamics

Governing equations for adiabatic flow with friction in a constant area duct, fannoline limiting conditions, effect of wall friction, flow properties in an isothermal flow with friction in a constant area duct governing equations, limiting condition. **(06)**

Unit 3: Flow Analysis

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables. **(06)**

Unit 4: Propulsion

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating

principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines, ramjet, pulsejet. **(06)**

Unit 5: Applications

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights, Comparison of various propulsion systems. **(06)**

Unit 6: Wind Tunnel

Types of wind tunnels - sub sonic wind tunnel, supersonic wind tunnel, projectile obstruction and shadow graph technique. **(06)**

Recommended/ Reference Books:

1. Ahmed F. El-Sayed, Aircraft Prpoulsion 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.

Web links:

1. https://nptel.ac.in/courses/112/106/112106166/
2. https://nptel.ac.in/courses/101/101/101101002/
3. https://freevideolectures.com/course/3535/gas-dynamics-and-propulsion

PEC-ME-605/21 WELDING TECHNOLOGY (PEC- I)
B. Tech (Mechanical Engineering) VI Semester

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

Pre- Requisite: Manufacturing Process

Successive: Project work

Course Objectives:

The objective of this course is to provide an insight on welding and allied processes, weld testing techniques and automation in welding.

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

CO 1 - Grasp the working principles and applications of oxyacetylene and electric arc welding.

CO 2 - Describe methods of modern and special welding processes.

CO 3 - Differentiate between non-destructive testing methods of weld joints.

CO 4 - Discuss the techniques of welding automation.

Course Contents:

Unit 1

Oxy-Acetylene Welding: Introduction to Welding processes and their principles, Industrial Applications, Principles of Oxy- Acetylene Welding, Procedure, Types of flames, Poping, Flashback and Backfire. Equipment and Accessories: Torches, Regulators, Pressure Gauges, Gas Cylinders, Filler Rods. Types of Welding Joints and Welding Positions, Common Welding Defects and their control **(6)**

Unit 2

Electric Arc Welding: Principle of Electric Arc Welding: Principle, Welding Procedure, Arc Length, Arc Force and Arc Blow. Equipment and Accessories: Welding Machines, A.C. and D.C. Transformers, Transformer-Rectifiers machines, Inverter based welding power sources, Types of Electrodes and Indian system of classification and coding of covered Electrodes for Mild Steels**.(6)**

Unit 3

Special and Allied Welding Processes: Metal Inert Gas Arc Welding (MIG): Principle, Advantage and Disadvantages of Gas Shielded Arc Welding, Types of Metal Transfer, Welding Equipment and Shielding Gases, Welding Parameters, MIG Welding and its components.CO_2 Welding: Advantage and disadvantages over MIG, Tungsten Inert Gas Arc Welding: Welding Equipment-Electrodes and their preparation, Inert gases and Torches, Submerged Arc Welding: Principle of the Process and its Applications, Type of Fluxes used in SAW process. **(8)**

Unit 4

Resistance Welding: Principle, Types and Applications, Equipment and Machinery required for Resistance Spot, Seam and Projection welding. Working Principle and applications of Ultrasonic welding, Electron Beam welding, Laser beam welding and Friction stir welding. **(7)**

Unit 5:

Non Destructive Testing of Welds: Non Destructive Tests: their Advantages and Limitations, Comparison with Destructive Tests, Visual Examination-Use of borescopes etc., Dye Penetrant Inspection, Magnetic Particle Inspection, Eddy Current Testing, X-Rays Inspection, Gamma Rays Inspection and Ultrasonic Inspection of Welds. **(7)**

Unit 6

Automation in Welding: Introduction, Manual Welding, Semi-Automatic Welding, Automatic Welding, Welding Mechanization, Flexible Automated Welding, Robotic Welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system. **(6)**

Recommended/ Reference Books:

1. Welding and Welding Technology by R. Little- Tata McGraw Hill Publication.
2. Welding Processes and Technology by R. S. Parmar- Khanna Publication.
3. Welding Technology by Koeingsberger, J. R. Adair- Macmillan.
4. Welding Technology by Rossi- Mc Graw Hill Publications.
5. Welding Handbook, Eighth Edition, Vol. 1 & 2- American Welding Society.

Web-links:

Fundamental of Welding Science and Technology	https://www.youtube.com/watch?v=g7MkIBdl06c&list=PLwdnzlV3ogoUQnGO8eFFygVBTjF0xyYMq
Welding Processes	https://www.youtube.com/watch?v=mmKy5PbndQI&list=PLyqSpQzTE6M-KwjFQByBvRx464XpCgOEC
Introduction to Welding Engineering	https://www.youtube.com/watch?v=m2B8t8vzeUE&list=PLbMVogVj5nJSjLB85-HKhw1aCIBxn3pWj
Welding Engineering	https://nptel.ac.in/courses/112/107/112107090/

PEC-ME-606/21 MECHATRONICS SYSTEMS (PEC-I)
B. Tech (Mechanical Engineering) VI Semester

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

Duration of Exam: 3 Hours

Pre- Requisite: Basics of Electronics Engineering

Successive: Automation in Manufacturing

Course Objectives:

The objective of this course is to get familiarized with the concepts and working of mechatronics systems.

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 using various types of sensors.

CO 2- Select appropriate actuators for practical applications.

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 and electrical systems.

Course Contents:

Unit 1

Introduction: Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro- processor Based Controllers; The Mechatronic Approach. A review of Displacement, Position Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors / along with Performance Terminology; Selection of Sensors; Input Data by Switches; Signal Conditioning; Brief Review of Operational Amplifier; Digital Signals; Multiplexers; Data Acqusition; Digital Signal Processing; Pulse Modulation; Data Presentation Systems – Displays; Data Presentation, Elements; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems. **(8)**

Unit 2

Pneumatic and Hydraulic Actuation Systems: Pneumatic and Hydraulic Systems; Directional Control Valves; Valve Symbols; Pressure Control Valves; Cylinder Sequencing; Process Control Valves; Rotary Actuators; Problems. **(8)**

Unit 3

Mechanical and Electrical Actuation Systems: 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. **(8)**

Unit 4

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, Problems. **(8)**

Unit 5

Digital Logic and Programmable Logic Controllers: A Review of Number Systems & Logic Gates; Boolean Algebra; Kanaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems. **(8)**

Recommended/ Reference Books:

1. Mechatronics by W. Bolton, Published by AdditionWesley.
2. Mechatronics System Design – Devdas Shetty and Richard A. Kolx Brooks/ Cole 1997.
3. Introduction to Mechatronics and Measuring System: David G. Alciation and Michael B. Hits and Tata McGraw Hill
4. Mechatronics – Sensing to Implementation - C.R.Venkataraman,Sapna.

Web Links:

S.No.	Address	Contents
1	https://www.youtube.com/watch?v=0pgGn4CkDTM	Pneumatic and Hydraulic Actuation Systems
2	https://www.youtube.com/watch?v=Oq25s1zWLmU	Electric Actuators
3	http://www.digimat.in/nptel/courses/video/112107214/L12.html	System Modelling

4	https://www.youtube.com/watch?v=PkFX7NjgEdA	PLC

PEC-ME-621/21 FLEXIBLE MANUFACTURING SYSTEMS (PEC-II)
B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: CAD/CAM

Successive: Nil

Course Objectives:

The objective of this course is to understand the basic concepts of automation and its mechanisms.

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

CO1- Understand the concept of automation and its mechanisms in manufacturing industries.

CO2- Apply group technology principles for cellular manufacturing.

CO3- Describe the flexible manufacturing systems.

CO4- Illustrate the technical features and programming methods of robots.

Course Contents:

Unit 1

Automation: Types of automation, reasons for automating, automation strategies, Detroit-type automation: Automated flow lines, methods of work part transport, Transfer mechanisms, buffer storage, automation for machining operations, Low cost automation. **(8)**

Unit 2

Automated Assembly Systems: Design for automated assembly, types of automated assembly systems, part feeding devices, quantitative analysis of the delivery system operation, analysis of a single-station assembly machine. **(8)**

Unit 3

Group Technology: Part families, parts classification and coding: Features of parts classification and coding systems, Opitz parts classification and coding system. Production flow analysis, Cellular manufacturing: composite part concept, types of machine cells and layouts, grouping parts and machines by Rank order clustering, applications of group technology. Single-minute exchange of die (SMED). **(8)**

Unit 4

Flexible Manufacturing Systems: Introduction, FMS components, types of FMS, FMS work stations. Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment. Computer control system, FMS applications and benefits. **(8)**

Unit 5

Robotic Technology: Joints and links, common robot configurations, work volume, types of robot control, accuracy and repeatability, other specifications, end effectors, sensors in robotics, Robot applications. **(6)**

Unit 6

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

Recommended/ Reference Books:

1. Automation, Production Systems and Computer Integrated Manufacturing-Groover M.P, Prentice Hall of India.

2. CAD/CAM – Groover M.P, Zimmers E.W, Prentice Hall of India.

3. Approach to Computer Integrated Design and Manufacturing: Nanua Singh, JohnWiley and Sons.

4. Production Management Systems: A CIM Perspective- Browne J, Harhen J,Shivnan J, Addison Wesley.

Web Links:

S.No	Address of web source	Content
1	https://nptel.ac.in/courses/112/104/112104288/	Automation
2	https://nptel.ac.in/courses/112/104/112104288/	Automated Assembly Systems
3	https://nptel.ac.in/courses/112/104/112104289/	Group technology
4	https://nptel.ac.in/courses/112/104/112104289/	Flexible manufacturing system
5	https://nptel.ac.in/courses/112/101/112101098/	Robotics
6	https://nptel.ac.in/courses/112/105/112105249/	Robotics

PEC-ME-622/21 RELIABILITY, AVAILABILITY & MAINTAINABILITY (PEC- II)

B. Tech (Mechanical Engineering) VI Semester

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

Course Objective:

The objective of the course is to provide the students with the fundamental concepts, the necessary knowledge and the basic skills related to systems reliability, availability and maintainability.

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

CO 1- Evaluate the reliability of a system and its subcomponents.

CO 2- Apply failure analysis techniques for systems.

CO 3- Perform reliability analysis of a system.

CO 4- Estimate systems availability and maintainability,

CO 5- Develop the Markov model for the mechanical systems.

Unit 1

Introduction to Reliability, Availability and Maintainability (RAM), Development of RAM Engineering, Reliability Availability and Maintainability utilization factors, MTBF, MTBR, MTTR, Reliability improvement and apportionment. **(8)**

Unit 2

Concept of terro-technology; Statistical distribution associated with reliability engineering; Quantitative measures of reliability, Bath tub curve; Quantitative; Fault tree analysis (FTA), Failure mode and effect analysis (FMEA), Failure mode, effect and criticality analysis (FMECA). **(8)**

Unit 3

Reliability engineering fundamentals and applications: Historical perspectives, Definition of Reliability, Role of Reliability evaluation, Reliability assessment, relationship between Different Reliability functions, typical Hazard functions such as safety audit, fire safety , Mean time to failure, Cumulative Hazard function and average failure rate. **(7)**

Unit 4

Application of Probability distribution function in Reliability evaluation combinational Aspects of Reliability, Markov models optimization of system Reliability. **(5)**

Unit 5

Maintainability: Definition and application of Maintainability Engineering, Factors affecting Maintainability. Maintainability design criteria, operating and down time categories, Mean time to activity restore equipment, Mean Maintenance man hours, Mean time for corrective and Preventive Maintenance. **(10)**

Unit 6

Availability: types of Availability, Steady state availability, approaches to increase equipment Availability, Markov analysis of availability**. (8)**

Recommended/ Reference Books:

1. Reliability Engineering and practice by Alessandro Birolini, Springer publication
2 An Introduction to Reliability and Maintainability Engineering by Charles E Ebeling , McGraw-Hill Publication
3 Reliability Assessment Engineering by Cher Ming Tan , Nova Science Publisher

Website link

S. N	Weblink	Content cover
1	https://www.mitre.org/publications/systems-engineering-guide/acquisition-systems-engineering/integrated-logistics-support/reliability-availability-and-maintainability#:~:text=Definition%3A%20Reliability%2C%20Availability%2C%20and,LCC)%20of%20a%20developed%20system.	**Unit-1,2,3**
2	**"https://www.youtube.com/embed/j6zB7emiobY" frameborder="0" allow="accelerometer; autoplay; clipboard-write; encrypted-media; gyroscope; picture-in-picture" allowfullscreen></iframe>https://youtu.be/yI8iIO1FXtA**	**Unit-4**
3	https://youtu.be/pVfByfoQ1lU	**Unit-5,6**

PEC-ME-623/21 PRINCIPLES OF MANAGEMENT (PEC-II)

B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Nil

Successive: Nil

Course Objectives:

The objective of this course is to understand the principles of management and their application towards the functioning of an organization.

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

CO 1-Understand the concepts of management and organization

CO 2-Develop planning and organizational management skills.

CO 3-Handle the complexities of human resource management with proper strategies.

CO 4-Analyze and control various processes within the organization using suitable tools and techniques.

Course Contents:

Unit 1

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. **(8)**

Unit 2

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes, PDCA. **(6)**

Unit 3

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, cross functional teams. **(10)**

Unit 4

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication. **(10)**

Unit 5

Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting, MIS. **(8)**

Recommended/ Reference Books:

1. Robbins S.P., Coulter M.A. (2018). Management (14th Ed.), Pearson Education, New Delhi.

2. Koontz, H., and Weihrich, H. (2015). Essentials of Management: An International, Innovation, and Leadership Perspective (10th Ed.), Tata McGraw Hills.

3. Tripathi P.C. & Reddy P.N. (2017). Principles of Management (6th Ed.), McGraw Hill.

4. Ghuman K. &Aswathapa K., (2017). Management concepts and cases (10th ed.), Tata McGraw Hills, New Delhi.

Web Links:

S.No.	Address of web source	Content
1.	http://oer2go.org/mods/en-oya/business-101/index.html	Unit 1, 2, 3, 4 , 5
2.	https://nptel.ac.in/courses/122/108/122108038/	Unit 1, 2, 3, 4 , 5

PEC-ME-624/21 AIRCRAFT TECHNOLOGY (PEC- II)
B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Thermodynamics, Fluid Mechanics

Successive: Project

Course Objectives:

The objective of this course is to understand the principles of operation of aircrafts, aerodynamics, general familiarization of aircraft engine systems, maintenance procedures and standard practices.

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

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

CO 2- Describe the principles and working of aircraft propulsion systems.

CO 3- Explain aerodynamics, inspection and maintenance of aircraft engines.

CO 4- Appraise different aviation systems.

Course Contents:

Unit 1

Principles of Flight: History of flights, Aircraft configurations, Flight control systems; Mechanical control, Powered control, Fly-By-Wire and digital Fly-By-Wire control systems, flying limits, Airframe & engine manufacturers. Material for Aircraft systems. **(6)**

Unit 2

Aircraft Thermodynamics: First law of thermodynamics, Second law of thermodynamics, Air standard cycles, Brayton cycle & its variants. **(6)**

Unit 3

Aircraft Propulsion: Thrust, Thrust equation, Propulsive efficiency, Factors effecting thrust, Fundamentals of gas turbine engines, Aircraft engine construction, compressor & its Classification, combustion chambers, classification and performance, gas turbines, its classification & operation, convergent/divergent nozzles, Type of aircraft engines; turbo jet, turbo-prop & turbo fan engines. **(9)**

Unit 4

Aerodynamics of Airplanes: Basics of aerodynamics, Wing airfoil profile and effects, Thrust, drag, lift & gravity, Control surfaces; aileron, elevator, rudder, slat, flap & spoiler, servo tab etc. Thrust reversers. **(6)**

Unit 5

Engine Systems, Inspection & Maintenance: Fuel system, Lubrication system, Compressor air flow control system, Turbine vanes and blade cooling, Cabin air conditioning, Full authority digital electronic engine control, Engine starting and ignition, Fire protection system, Engine Inlet cowling anti icing, environmental control system, engine indicating system, Aero engine maintenance & overhauling. **(6)**

Unit 6

Miscellaneous Aviation

Concepts and flight of Helicopter, Drone, Air taxi, Rocket etc. History & overview of air war fare, Difference between civil & fighter craft aerodynamics & engines, Development & types of fighter crafts, fighter craft weapons & firing, Safety, maintenance & emergency features. Mari-time fighters. **(6)**

Recommended/ Reference Books:

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

Web Links:

S.N	Address of web source	Content

1	https://en.wikipedia.org/wiki/Aviation	
2	https://en.wikipedia.org/wiki/Thermodynamics	Thermodynamics
3	https://nptel.ac.in/courses/101/101/101101002/	Prop
4	https://www.nasa.gov/centers/glenn/home/index.html	Aerodynamics

PEC-ME-625/21 NUMERIC CONTROL OF MACHINE TOOLS, ROBOTICS AND RAPID PROTOTYPING
(PEC-II)
B. Tech (Mechanical Engineering) VI Semester

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

Course Objectives:

The objective of studying this course is to acquaint the students about the numerical control systems and to develop related programming skills. Emphasis will be on modern manufacturing methods like robotics and additive manufacturing.

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

- **CO 1-** Understand the basic concepts of numerical control along with related steps tooling.
- **CO 2-** Describe the functions and working of Computer Numerical Control, Direct Numerical control, Distributed Numerical Control and Adaptive Control systems
- **CO 3-** Discuss features and components of CNC machines.
- **CO 4-** Apply codes and develop CNC part programs.
- **CO 5-** Describe basic physical configurations and features of a robots and develop robot programs for simple operations
- **CO 6-** Express the principles and applications additive manufacturing and rapid prototyping

Course Contents:

Unit 1

Numerical Control: Introduction to numerical control (NC) System, Basic components 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. **(6)**

Unit 2

Computer Numerical Control: Basic concept of computer Numerical control (CNC) system, advantages of CNC, functions of CNC system, Direct Numerical Control (DNC) system, components of a DNC system, functions of DNC, advantages of DNC, distributed numerical control and adaptive control system. **(6)**

Unit 3

CNC Machines: Features and components of CNC Machining and turning centres ,Functions of ATC and APC. CNC EDM and its features and components **(6)**

Unit 4

CNC programming: Input media and coding formats. Manual part programming for CNC Turning and Machining Centres, cutter diameter and length compensation, Computer assisted part programming, NC part programming languages, APT language, geometry statements, motion statements, post processor statements, auxiliary statements., practice and development of part programs using turning and machining centres **(9)**

Unit 5

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: Lead through programming and robot programming languages, practice and development robot programs for Drawing/pick and place/welding operations **(7)**

Unit 6

Rapid prototyping and Additive Manufacturing: Introduction to Rapid prototyping, Additive Manufacturing and 3D printing, types of technologies and machines used for 3D printing, materials used for 3D printing, applications of 3D printing in manufacturing industry. **(6)**

Recommended/ Reference Books:

1. CNC Technology and Programming- Tilak Raj, Dhanpat Rai Publishing Company, New Delhi

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

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

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

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

Web Links:

1. https://video.search.yahoo.com/search/video;_ylt=Awr9CW6vdwFfxvcABCJXNyoA;_ylu=X3oDMTByNWU4cGh1BGNvbG8DZ3ExBHBvcwMxBHZ0aWQDBHNlYwNzYw--?p=NPTEL+lectures+on+CNC+machines&fr=mcafee#id=2&vid=1e4ffe1da9bd34c387cae97a1ba414c3&action=view
2. https://video.search.yahoo.com/search/video;_ylt=Awr9CW6vdwFfxvcABCJXNyoA;_ylu=X3oDMTByNWU4cGh1BGNvbG8DZ3ExBHBvcwMxBHZ0aWQDBHNlYwNzYw--?p=NPTEL+lectures+on+CNC+machines&fr=mcafee#id=1&vid=d2d7faadc0383d1451e974740a028346&action=view
3. https://video.search.yahoo.com/search/video;_ylt=Awr9CW6vdwFfxvcABCJXNyoA;_ylu=X3oDMTByNWU4cGh1BGNvbG8DZ3ExBHBvcwMxBHZ0aWQDBHNlYwNzYw--?p=NPTEL+lectures+on+CNC+machines&fr=mcafee#id=5&vid=d6aed0675e89f79aa763b69afe967f6e&action=view
4. https://video.search.yahoo.com/search/video;_ylt=Awr9CW6vdwFfxvcABCJXNyoA;_ylu=X3oDMTByNWU4cGh1BGNvbG8DZ3ExBHBvcwMxBHZ0aWQDBHNlYwNzYw--

?p=NPTEL+lectures+on+CNC+machines&fr=mcafee#id=11&vid=b171b78e20ad9f1c55952d3bfd425da2&action=view

5. https://www.youtube.com/watch?v=C_zPZoLclJY
6. https://www.youtube.com/watch?v=5b8P3flb26I

PEC-ME-626/21 INDUSTRIAL TRIBOLOGY & LUBRICATION (PEC-II)

B. Tech (Mechanical Engineering) VI Semester

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

Pre- Requisite: Fluid Mechanics

Successive: Nil

Course Objectives:

The objective of this course is to study the concepts of friction and wear and to minimize their effects by lubrication on different surfaces.

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

CO 1- Apply the basic theories of friction, wear and lubrication to predict the frictional behavior of commonly encountered sliding interfaces.

CO 2- Describe the types of wear and its measurement methods.

CO 3- Discuss the different modes of lubrication and film lubrication theory.

CO 4- Understand the concepts of surface engineering and make selection for bearing materials.

Course Contents:

Unit 1

Surfaces and Friction: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction -Adhesion Ploughint- Energy dissipation mechanisms, Friction Characteristics of metals - Friction of non-metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction. Source of Rolling Friction - Stick slip motion - Measurement of Friction. **(8)**

Unit 2

Wear- Types of wear: Simple theory of Sliding Wear Mechanism of sliding wear of metals - Abrasive wear. Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements. **(8)**

Unit 3

Lubricants and Lubrication Types: Types and properties of Lubricants - Testing methods - Hydrodynamic Lubrication – Elasto hydrodynamic lubrication- Boundary Lubrication - Solid Lubrication Hydrostatic Lubrication. **(8)**

Unit 4

Film Lubrication Theory: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation, Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings -Virtual Coefficient of friction - The Somerfield diagram. **(8)**

Unit 5

Surface Engineering and Materials for Bearings: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - 103 Plating and anodizing Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings. **(8)**

Recommended/ Reference Books:

1. I.M. Hutchings, Tribology, Friction and Wear of Engineering Material, Edward Arnold

2. T.A. Stolarski, Tribology in Machine Design , Industrial Press Inc

3. E. P.Bowden and Tabor.D., Friction and Lubrication , Heinemann Educational Books Ltd 4. A. Cameron, Basic Lubrication theory , Longman, U.K.., 1981.

5. M. J.Neale (Editor), Tribology Handbook, Newnes. Butter worth, Heinemann, U.K

Web Links:

S.	Address of web source	Content
1	https://nptel.ac.in/courses/112/102/112102015	UNIT III Lubricants and Lubrication Types, Film Lubrication Theory
2	https://freevideolectures.com/course/3142/tribology	UNIT II Wear- Types of wear, Friction
3	*https://en.wikipedia.org/wiki/Tribology*	Tribology Introduction
4	https://www.youtube.com/watch?v=u27gQblSxP8	Bearing

PEC-ME-627/21 ELECTRIC VEHICLE AND TRANSMISSION SYSTEM (PEC-II)
B. Tech (Mechanical Engineering) VI Semester

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

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

Pre- Requisite: Design of Machine Elements

Successive: Nil

Course Objectives:

The objective of studying this course is to learn about the design procedures for Electric Vehicle and Transmission System components.

Course Outcomes: Upon completing this course the students will be able to:

CO 1- Learn various components of Electric Vehicles and hybrid vehicles.

CO 2- Understand Electric Vehicle Architecture Design.

CO 3- Aquire skill of designing Electric Drive-trains.

CO 4- Analyze Electric Propulsion unit and supporting system.

Course Contents:

Unit 1

Introduction to Electric Vehicle: Conventional Vehicles, Comparison with Internal combustion Engine : Technology, Requirements in Electric Vehicles, History of electric vehicles, Components of Electric Vehicle, Introduction to Energy Storage, Battery based energy storage and its analysis, Battery Electric vehicle and its components: Types of Motors, Selection and sizing of Motor, Motor Controllers, Electrical protection and system requirement. **(8)**

Unit 2

Electric Vehicle Architecture Design: Types of Electric Vehicle, Photovoltaic solar based electric vehicle design, Hybrid electric vehicle (HEV), History of hybrid vehicles, Introduction to electric components used in hybrid ,social and environmental importance of hybrid and electric vehicles, Fuel cell electric vehicle (FCEV).Type of Charging station, Selection and Sizing of charging station. Components of charging station. **(8)**

Unit 3

Electric Drive-trains: Calculating the rolling resistance, Calculating the grade resistance, Finding the total tractive effort and Torque required on the drive wheel, Basic concept of electric traction, Introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, Vehicle power source characterization. **(8)**

Unit 4

Electric Propulsion unit: Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. **(8)**

Unit 5

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, supporting subsystems.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV). **(8)**

Recommended/ Reference Books:

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press.
2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press.
3. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons.
4. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier.
5. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer.

Weblink for online learning: https://www.nptel.ac.in/content/108103009

PEC-ME-701/21 MAINTENANCE ENGINEERING AND MANAGEMENT (PEC- III)
B. Tech (Mechanical Engineering) VII/VIII 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:

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- Classify different types of maintenance.

CO3- Describe the condition monitoring and optimal maintenance policies.

CO4- Explore the concepts of TPM.

Unit 1

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. **(10)**

Unit 2

Classification of maintenance approach: Introduction, Planned Maintenance- Unplanned Maintenance, Preventive Maintenance- Corrective Maintenance- Basic Principle and objective, advantages, disadvantages, Basic requirements. **(7)**

Unit 3

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. **(7)**

Unit 4

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. **(10)**

Unit 5

Total Productive Maintenance: Development and scope of concept, technology, basic systems of TPM procedure and steps of TPM, productivity circle. **(7)**

Recommended/ Reference Books:

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.

Web Links

Web link	Contents
https://nptel.ac.in/courses/112/105/112105232/	Maintenance Principles
https://www.onupkeep.com/learning/maintenance-types/	**Classification of maintenance approach** Introduction, Planned Maintenance- Unplanned Maintenance, Preventive Maintenance- Corrective Maintenance- Basic Principle and objective, advantages, disadvantages, Basic requirements.
https://nptel.ac.in/courses/112/105/112105232/	Condition Monitoring
https://nptel.ac.in/courses/112/105/112105048/	Condition Monitoring
https://www.youtube.com/watch?v=UOuTBCrW2kY	**Total Productive Maintenance** Development and scope of concept, technology, basic systems of TPM procedure and steps of TPM, productivity circle

PEC-ME-702/21TOTAL QUALITY MANAGEMENT (PEC-III)
B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Industrial Engineering

Successive: Nil

Course Objectives:

To facilitate the understanding of Total Quality Management principles and processes.

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

CO1- Understand the basic concepts of quality and total quality management.

CO2-.Analyse the role of soft options in TQM.

CO3- Comprehend underlying principles of TQM.

CO4- Understand various tools and techniques of TQM.

CO5- Learn about different types of quality awards.

Course Contents:

Unit 1

Introduction: Quality – Basic concepts, need for quality, evolution of quality, dimensions of quality. **(4)**

Unit 2

Total Quality Management: Definition, journey from inspection to TQM, dimensions of TQM, TQM viewpoints, reasons for adopting TQM, components of TQM, steps in TQM implementation, Roadblocks in TQM implementation, Reasons for TQM failure, Factors affecting TQM environment. **(10)**

Unit 3

Role of soft options in TQM: Hard vs. Soft factors, Role and expectation of employer, employee, customer and supplier from organization and vice versa. Human factors in TQM, Role of top management commitment, work culture, motivation, coordination, attitude, innovation. **(8)**

Unit 4

TQM Principles: Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal. **(6)**

Unit 5

Tools and techniques in TQM: Introduction to SQC, Six sigma- concepts, methodology, Benchmarking process, Introduction to total productive maintenance. **(8)**

Unit 6

Quality awards – MBNQA, Deming award, European quality award, Australian quality award, National quality awards. **(6)**

Recommended/ Reference Books:

1. Total Quality Management- Oakland (Butterworth – Heinamann Ltd.)

2. Managing for total quality from Deming to Taguchi and SPC - Logothetis N. (PHI)

3. Total Quality Control - Feigenbaum A.V. (MGH)

4. Total Quality Management - Besterfield Dale H (Pearson Education)

5. Total Quality Management (TQM): Principles, Methods, and Applications - Sunil Luthra, Dixit Garg, AshishAgarwal, Sachin K. Mangla (CRC Press)

Web Links:

S.N	Address of web source	Content
1	https://nptel.ac.in/courses/110/104/110104080/	Quality
2	https://nptel.ac.in/courses/110/104/110104080/	Total quality management
3	https://nptel.ac.in/courses/110/104/110104080/	Tools and techniques in TQM

PEC-ME-703/21 NON CONVENTIONAL ENERGY RESOURCES UTILIZATION (PEC-III)

B. Tech (Mechanical Engineering) VII/VIII Semester

No. of Credits: 3

L T P Total
3 0 0 3

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

Pre- Requisite: Thermodynamics

Successive: Nil

Course Objectives:

The objective of this course is to study energy resources, energy planning and their utilization.

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

CO 1- Understand the energy resources and its requirement.

CO 2- Understand production and utility of bio-gas and solar energy.

CO 3- Describe concept and application of wind energy.

CO 4- Understand tidal energy as alternate resource.

CO 5- Discuss the utility of thermoelectric Systems.

Course Contents:

Unit 1

Energy Resources and their Utilization : Indian and global energy sources, Energy exploited, Energy planning including Indian Energy Policy, 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. **(6)**

Unit 2

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.

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

Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system, Batteries for Solar System. **(06)**

Unit 3

Biogas: Photosynthesis, Bio gas production, Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India. **(06)**

Unit 4

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.**(06)**

Unit 5

Tidal Power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy, Limitations of tidal energy conversion systems.

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. **(06)**

Unit 6

Thermoelectric Systems: 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. **(06)**

Recommended/ 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.

Web link	contents
https://nptel.ac.in/courses/121/106/121106014/	**Solar Energy:**
https://nptel.ac.in/courses/121/106/121106014/	**Bio Mass**
https://nptel.ac.in/courses/121/106/121106014/	**Ocean Energy**
https://nptel.ac.in/courses/121/106/121106014/	**Wind Energy**

PEC-ME-704/21 AIR CONDITIONING EQUIPMENTS (PEC-III)
B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Thermodynamics, Refrigeration and Air Conditioning

Successive: Nil

Course Objectives:

The objective of this course is to study and analyze the different equipments used in Refrigeration & Air Conditioning Systems.

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

CO 1- Understand the construction and working principles of different type of filters, Humidifiers and dehumidifiers.

CO 2- Analyze the performance of condensers, evaporators and cooling towers used in RAC system.

CO 3- Describe the different compressors used in RAC systems.

CO 4- Illustrate and analyze the working of fans, pumps, expansion devices and different motors used in RAC systems.

Course Contents:

Unit 1

Filters and Humidifiers: Air Cleaning, Air Filters, Methods of Air Cleaning, Different types of Air Filters, Selection of Air Filters, Performance of air Filters, Odour Removal, Clean Room for Industrial applications. Humidifiers: Need of Humidifiers, Methods of Humidification, Various types of Humidifiers, Dehumidifiers: Need of Dehumidifiers, Methods of Dehumidification and Various types of Dehumidifiers. **(7)**

Unit 2

Condensers and Cooling Towers: Types of Cooling Medium and their Selection, Air and Water cooled Condensers, Economic Operation of Condenser, Different Types of Water Cooled Condensers, Spray Ponds, Cooling Towers, Natural, Forced and Induced Draft Cooling Towers, Design Analysis of Cooling Towers, Performance Analysis of Condensers and Cooling Towers. **(7)**

Unit 3

Evaporators: Factors Considered for Design of Evaporators, Evaporator Types: Flooded and Dry Evaporators, Natural and Forced Convection, Shell and Tube, Shell and Coil, Plate type and Secondary Evaporators. Application of Fins, Temperature distribution and Heat flow in Evaporator, Pressure drop, Fouling correction factor, Selection of Evaporators**.(6)**

Unit 4

Compressors: Reciprocating, Rotary, Scroll, Centrifugal, Screw and Thermo-Compressor Compressors (Excluding the Analysis), Factors Affecting the Performance of Reciprocating Compressor, Capacity Control of Compressors, Compressors for Eco-friendly Refrigerants, Variable Drive Compressor and Future Trends in Refrigeration Compressors and Selection of Compressors, Inverter based technology and variable refrigerant flow system**.(7)**

Unit 5

Fans: Types, Axial Flow Fans, Centrifugal Fans, Total Pressure Developed by Fan, Fan air power and Efficiencies, Problems, Pumps: Types, Reciprocating, Gear or Rotary and Centrifugal Pumps, Selection of Fans and Pumps**.(6)**

Unit 6:

Expansion Devices: Capillary tube, Automatic Expansion, Thermostatic Expansion, High-Side float, Low-Side Float and Solenoid Control Valves, Electronic expansion valve, Introduction to Electric Motors and their Applications, Variable speed motors, variable frequency drive for motors, Introduction to Motor Starting Relays and Motor Overload Protector. **(6)**

Recommended/ Reference Books:

1. Refrigeration and Air Conditioning by C.P. Arora – TMH.

2. Refrigeration and Air Conditioning by S.C.Domkundwar – Dhanpat Rai & Sons

3. Refrigeration and Air Conditioning by D.S. Kumar- Kataria and Sons

4. Carrier Hand Book for HVAC Engineers.

Web Links:

S.N	Address of web source	Content
1.	https://www.ashrae.org/technical-resources/ashrae-handbook/ashrae-handbook-online	RAC system components
2	https://www.danfoss.com/en-gb/service-and-support/learning/cooling-learning/	Expansion devices, Compressor
3	https://nptel.ac.in/courses/112/105/112105129/	Condenser, evaporator,

		compressor, expansion devices, ducts

PEC-ME-705/21 TOOL DESIGN (PEC-III)

B. Tech (Mechanical Engineering) VII/VIII 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: Machine Design

Successive: Project

Course Objectives:

The objective of this course is to enable the students to design different types of tools and gauges to be used in manufacturing processes

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- Design single point and multipoint cutting tools

CO 3- Design jigs and fixtures for manufacturing processes

CO 4- Design different types of gauges

Course Contents:

Unit 1

Tool inserts, holders and quality of machine surfaces: Advanced cutting tool materials, Tool inserts, ISO specifications of inserts and tool holders, ISO tool shapes, type of tools, work hardening, and quality of machines surfaces. **(6)**

Unit 2

Design of single point and form tool: Design of single point turning tool: shank design, cutting edge design, tool signature and selection tool angles, provision of chip control, shank and tool designations.

Design of flat and circular form tools: introduction, types of form tool, design of circular and flat form tool. **(7)**

Unit 3

Design of Drill and Reamer: Nomenclature of reamers, reamer classification and designation, speed, feed and depth of cut, factors affecting the design of reamers, Reamer design

Drill: types of drill, nomenclature of drill, drill materials and design of drill. **(7)**

Unit 4

Design of milling cutter and Broach: Elements of milling cutter, classification of milling cutters, Design of a milling cutter.

Introduction to broaching operation, Elements of a broach, Types of broaches, broach material design of a round broach. **(8)**

Unit 5

Design of Jigs and Fixtures: Introduction to jigs and fixtures, location and clamping devices, Design of drill jigs, Design of milling fixtures. **(7)**

Unit 6

Gauges and Gauge Design: introduction, elements and their function, tailor's principle of gauge design Design of Plug Gauges and Ring Gauges, Standards, materials for gauges, maintenance and safety of gauges. (6)

Recommended/ Reference Books:

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

Web Links:

1. https://video.search.yahoo.com/search/video?fr=mcafee&p=nptel+lectures+on+jigs+and+fixture+designs#id=2&vid=bd6d74f1fb7b4920660f5a0ca4f9c012&action=view
2. https://video.search.yahoo.com/search/video?fr=mcafee&p=nptel+lectures+on+jigs+and+fixture+designs#id=3&vid=cb9866b32ab3efb3d16b66fef66d08a0&action=view
3. https://video.search.yahoo.com/search/video?fr=mcafee&p=nptel+lectures+on+jigs+and+fixture+designs#id=4&vid=bfb721c7ff8990445d7e5cd1142681ea&action=view
4. https://video.search.yahoo.com/search/video?fr=mcafee&p=nptel+lectures+on+design+of+inspection+gauges+youtube#id=11&vid=787146bed2536eb45a152b5e8069d213&action=view
5. https://video.search.yahoo.com/search/video?fr=mcafee&p=nptel+lectures+on+design+of+inspection+gauges+youtube#id=37&vid=95b9c80d06e468826f5d83da9156843d&action=view

PEC-ME-706/21 ACOUSTICS AND VIBRATIONS (PEC-III)
B. Tech (Mechanical Engineering) VII/VIII 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: Engineering Mechanics, Strength of Materials

Successive: Nil

Course Objectives:
The objective of this course is to study essential concepts for mechanical vibrations induced in various equipments. To study single degree of freedom, two degree of freedom system, vibration absorber and analyze effects of vibrations on mechanical equipment.

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

CO 1- Learn vibrations leading to analysis of first degree of freedom.
CO 2-Analyze two degree of vibration and vibration isolation and transmissibility

CO 3- Analyze multi degree of freedom systems using various numerical methods

CO 4- Understand the influence and stiffness coefficients

CO 5-Understand the transient vibrations.

Course Contents:

Unit 1

Introduction: Harmonic motion, periodic motion, vibration terminology, **Single Degree of freedom Systems:** Free and forced vibrations with and without damping, magnification factor, transmissibility and isolation. **(6)**

Unit 2

Two degree of Freedom Systems: Generalized co-ordinates, principal co-ordinates, derivation of equation of motion, co-ordinate coupling, Lagrange's equation. **Vibration Absorber:** Tuned absorber, determination of mass ratio, tuned and damped absorber (qualitative treatment only), untuned viscous damper. **(7)**

Unit 3

Multi Degree of Freedom system: Derivation of equation, calculation of natural frequencies by Rayleigh, Stodala, matrix, matrix iteration and Holzer methods. **(6)**

Unit 4

Vibration Analysis: Introduction, Influence coefficient, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes. **(7)**

Unit 5

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. **(6)**

Unit 6

Basics of Acoustics: Introduction, frequency, acoustical sources, Properties of elementary acoustic sources: Point source (monopole), line source, loudness, decibel scale, octave, music scale. Sound pressure. Acoustic measures: SPL, rms, Leq, levels, Complex notation of harmonic signals. Freq. domain: Spectra, 1/3-octave and octave bands, A-,B-, and C-weighting. (6)

Unit 7

Physical phenomena influencing sound propagation: Damping, reflection, scattering, diffraction, refraction. Snell's law,Vehicle acoustics in general and development trends, Silencers, Road traffic noise and city planning. **(6)**

Recommended/ Reference Books:

1. Mechanical Vibration – V.P.Singh, Dhanpat Rai & Sons.
2. Mechanical Vibration :G.K.Grover – Nem Chand & Bros., Roorkee, INDIA
3. Fundamentals of Acoustics, Lawrence E. Kinsler, Austin R. Frey, Wiley Publishers.
4. Thomson, W.T, "Theory of Vibration with Applications", CBS Pub. & Distributors.
5. Tse, Morse and Hinkle, " Mechanical Vibration", prentice Hall of India Ltd.
6. Schaum Outline Series, "Mechanical Vibration", Mc Graw Hill Book Company.
7. Lindley and Higgins, "Maintenance Engineering Hand Book" McGraw Hill Book Company.

Web Links:

S.N.	Address of Web Source	Contents
1	https://www.youtube.com/watch?v=hWNpID0TWYU	Basics of Vibration
2	https://www.youtube.com/watch?v=WaS3SmYutuo	Single degree of Freedom system

PEC-ME-721/21 NEW VENTURE CREATION (PEC-IV)

B. Tech. (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Industrial Engineering

Successive: Product Design and Development

Course Objectives:

The aim of this course is to provide know-how for being able to launch a new venture by identifying the entrepreneurial opportunities, support and resource requirements.

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

CO 1-Acquire knowledge about entrepreneur and entrepreneurship.

CO 2- Understand the various activities involved in establishment of small scale enterprises.

CO 3-Identify the operational issues of small scale enterprises.

CO 4-Understand the performance appraisal methods and growth strategies.

CO 5-Comprehend the life cycle approach of production management.

Course Contents:

Unit 1

Entrepreneur and Entrepreneurship: Introduction; Entrepreneur and Entrepreneurship; Role of entrepreneurship in economic development; Entrepreneurial competencies and motivation; Institutional Interface for Small Scale Industry/Enterprises. **(6)**

Unit 2

Establishing Small Scale Enterprise: Opportunity Scanning and Identification; Creativity and product development process; Market survey and assessment; choice of technology and selection of site. **(8)**

Unit 3

Planning a Small Scale Enterprises: Financing new/small enterprises; Techno Economic Feasibility Assessment; Preparation of Business Plan; Forms of business organization/ownership, Preparation of project report. **(8)**

Unit 4

Operational Issues in SSE: Financial management issues; Operational/project management issues in SSE; Marketing management issues in SSE; Relevant business and industrial Laws. **(8)**

Unit 5

Performance appraisal and growth strategies: Management performance assessment and control; Causes of Sickness in SSI, Strategies for Stabilization and Growth. **(6)**

Unit 6

Life cycle of production management: Stages in life cycle of production management and Major managerial Decisions involved in each stage. **(4)**

Recommended/ Reference Books:

1. Bruce R Barringer and R Duane Ireland, Entrepreneurship: Successfully Launching New Ventures, 6th ed., Pearson Edu., 2019.

2. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.

3. Dr. S.S. Khanka, Entrepreneurial Development (4th ed.), S Chand & Company Ltd., 2012.

4. Dr. Vasant Desai, Management of Small Scale Enterprises, Himalaya Publishing House, 2004.

Web Links:

S.N	Address of web source	Content
1.	https://nptel.ac.in/courses/110/106/110106141/	Unit 1 to 5
2.	https://nptel.ac.in/courses/127/105/127105007/	Unit 1 to 5

PEC-ME-722/21 PROJECT MANAGEMENT (PEC-IV)
B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Nil

Successive: Nil

Course Objective:

The objective of this course is to inculcate knowledge and skills for developing & managing a project.

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

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

CO 2-Describe and develop project network.

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

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

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

Course Contents:

Unit 1

Introduction & Overview: Definitions, Project characteristics, Taxonomy of projects, Project life cycle (Project phases), Skill set of project manager, computer aided project management system. **(6)**

Unit 2

Project Selection process: Project Identification and Screening; Project feasibility study; Project Appraisal: Market, Technical, social, Ecological, Economical& Financial; Project Selection: Pragmatic, pair wise, MADM approach. **(8)**

Unit 3

Development of Project Network: Project description, Work break down structure, Nomenclature, Rules for drawing and representation, consistency and Redundancy inProject Networks, Matrix representation, Basic Scheduling with Networks (Forward &Backward Pass). **(6)**

Unit 4

CPM& PERT: Network diagram, Activity times, Critical path, Completion, Floats, Probability (Normal Distribution usage), and Numerical Problems. **(6)**

Unit 5

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

Unit 6

Role of Human Factors and Project completion: Dealing with people, Team Building and Leadership in Projects, Cross-functional team and change management, commitment, work culture, motivation, coordination, attitude, and innovation. Project Completion, Review and Future Directions. **(8)**

Recommended/ Reference Books:

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

Web Links:

S.No	Address of web source	Content
1	https://en.wikipedia.org/wiki/Project_management	Overview
2	http://freevideolectures.com/Course/2371/Project-and-Production-Management	20 different video lectures (Prof Arun Kanda, IIT Delhi)
3	https://www.youtube.com/watch?v=DdDzybQ_9vM	CPM (Dr. Pamela Zelbst, Sam Houston State University
4	https://www.youtube.com/watch?v=hWpQcPUM0Y0&t=339s	PERT (Prof. Sandeep Grover, JCB UST, Faridabad)
5	https://www.youtube.com/watch?v=NjihSDb-uaA	Resource Leveling(NPTEL)

PEC-ME-723/21 AUTOMOBILE ENGINEERING (PEC- IV)
B. Tech (Mechanical Engineering) VII/VIII 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:

The objective of this course is 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 basic components of automobile vehicle.

CO 2- Explain the various power transmission means.

CO 3- Discuss the various suspension and steering systems.

CO 4- Describe the braking systems and tyres.

Course Contents:

Unit 1

Introduction

Types of automobile vehicles, vehicle construction and layouts, Vehicle frame and body, vehicle aerodynamics, Requirements of Automobile Body; Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in Automobiles, Introduction to Hybrid and Electric Vehicle. **(6)**

Unit 2

Power Transmission and Axle: Requirements of transmission system, Clutches and their types, Different types of Gear Boxes- Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes, epicyclic gear box, continuous variable transmission (CVT). **(6)**

Unit 3

Drive lines and Axle: Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles. **(6)**

Unit 4

Suspension System: Terms related to suspension system, Need of Suspension System, Types of Suspension-double-wishbone, Mac Pherson strut and solid axle suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs. **(6)**

Unit 5

Steering System: Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toein/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering. **(6)**

Unit 6

Automotive Brakes, Tyres &Wheels: Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes, ABS, Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes. **(6)**

Recommended/ Reference Books:

1.T K Garrett, Motor vehicle, 13th ed., Elsevier.

2. Crouse and Anglin Automotive Mechanics, 10th edition Tata McGraw Hill, New Delhi.

3. Heitner J., Automotive Mechanics, 2nd ed., East-West Press, 1999.

4. Heisler H., Advanced Engine Technology, SAE International Publ., USA, 1998.

Web Links:

S.N	Address of web source	Content
1	http://www.nptel.ac.in	Unit 1, Unit 2

PEC-ME-724/21 DESIGN OF THERMAL SYSTEMS (PEC-IV)
B.Tech (Mechanical Engineering) VII/VIII 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

Successive: Nil

Course Objectives:

The objective of this course is to aware the students about the use of thermodynamic concepts in design the thermal systems.

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

CO 1 – Understand the basics of thermal system design.

CO 2 – Able to do modelling and design analysis.

CO 3 – Apply the exergy and heat transfer concepts in design of thermal systems.

CO4 – Apply concepts of heat and fluid flow in design.

Course Contents:

Unit 1

Introduction to Thermal System Design: Different types of thermal systems, Efficiency and effectiveness evaluation of different thermal systems, Overview of design process for thermal systems, Life-Cycle Design of Thermal System, Safety and Reliability, Performance evaluation and Cost analysis, Sample Problem Base-Case Design, introduction to Computer-Aided Thermal System Design: Preliminaries, Process Synthesis Software, Analysis and Optimization: Flow sheeting Software. **(6)**

Unit 2

Thermodynamics, Modelling, and Design Analysis: Basic Concepts and Definitions: Preliminaries, The First Law of Thermodynamics, Energy, The Second Law of Thermodynamics, Entropy and Entropy Generation, Control Volume Concepts: Mass, Energy and Energy Balances, Control Volumes at Steady State, Ancillary Concepts, Property Relations: Basic Relations for Pure Substances, Multicomponent System, Reacting Mixtures and Combustion: Combustion, Enthalpy of Formation, Absolute Entropy, Ancillary Concepts, Thermodynamic Model – Cogeneration System, Modelling and Design of Piping Systems: Design Considerations, Estimation of Head Loss, Piping System Design and Design Analysis, Pump Selection. **(7)**

Unit 3

Exergy Analysis: Exergy: Preliminaries, Defining Exergy, Environment and Dead States, Exergy Components, Physical Exergy: Derivation, Discussion, Exergy Balance: Closed System Exergy Balance, Control Volume Exergy Balance, Chemical Exergy: Standard Chemical Exergy, Standard Chemical Exergy of Gases and Gas Mixtures, Standard Chemical Exergy of Fuels, Applications: Cogeneration System Exergy Analysis, Exergy Destruction and Exergy Loss, Exergetic Efficiency, Chemical Exergy of Coal, Char, and Fuel Oil, Guidelines for Evaluating and Improving Thermodynamic Effectiveness. **(7)**

Unit 4

Heat Transfer, Modelling, and Design Analysis: The Objective of Heat Transfer, Conduction: Steady Conduction, Unsteady Conduction, Convection: External Forced Convection, Internal Forced Convection, Natural Convection, Condensation, Boiling, Radiation: Blackbody Radiation, Geometric View factors, Diffuse-Gray Surface Model, Two-Surface Enclosures, Enclosures with More Than Two Surfaces, Gray Medium Surrounded by Two Diffuse-Gray Surfaces. **(7)**

Unit 5

Applications with Heat and Fluid Flow: Thermal Insulation, Fins: Known Fin Width, Known Fin Thickness, Electronic Packages: Natural Convection Cooling, Forced Convection Cooling, Cooling of a Heat-Generating Board Inside a Parallel-Plate Channel. **(6)**

Unit 6

Applications with Thermodynamics and Heat and Fluid Flow: Heat Exchangers, The trade-off Between Thermal and Fluid Flow Irreversibility's: Local Rate of Entropy Generation, Internal Flows, External Flows, Nearly Ideal Balanced Counter flow Heat Exchangers, Unbalanced Heat Exchangers, Air Preheated Preliminary Design: Shell-and-Tube Counter flow Heat Exchanger, Plate-Fin Cross flow Heat Exchanger, Additional Applications: Refrigeration, Power Generation, Exergy Storage by Sensible Heating, Concluding Comment. **(7)**

Recommended/ Reference Books:

1. Thermal Design and Optimization – by Adrian Bejan – John Wiley & Sons, Inc.
2. Advanced Engineering Thermodynamics - by Adrian Bejan – John Wiley & Sons, Inc.
3. Heat Transfer – by J.P Holman
4. Air Conditioning Engineering – by W.P. Jones – Butterwouth
5. Heating, Ventilating and Air Conditioning – by Mc Quistion, Parker & Spitler – John Wiley Publishing Co.

PEC-ME-725/21 METALLURGY (PEC-IV)
B. Tech (Mechanical Engineering) VII/VIII 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: Materials Engineering

Successive: Nil

Course Objectives

The objective of this course is to provide students a deep insight of various metallurgical phenomena alongwith the properties of different engineering materials and characterisation techniques.

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

- **CO 1:** Understand the fundamentals of solidification process and grain growth
- **CO 2:** Describe Diffusion in solids and elements of grain boundaries
- **CO 3:** Explain Precipitation in metallic alloys
- **CO 4:** Discuss the properties and application of various engineering materials
- **CO 5:** Analyze materials using metallography and characterization techniques

Unit 1

Solidification of Metals: The liquid phase, nucleation, crystal growth from the liquid phase,the heats of fusion and vaporization, the nature of the liquid-solid interface,continuous growth, lateral growth, stable interface freezing, dendritic growth in pure metals, freezing in alloys with planar interface, the Scheilequation. **(6)**

Unit 2

Diffusion in solids: Introduction to diffusion in solids, Fick's 1^{st} and 2^{nd} law, diffusion mechanisms, steady-state diffusion, nonsteady-state diffusion, factors that influence diffusion.

Elements of Grain Boundaries: Grain boundaries, types of grain boundaries, the five degrees of freedom of a grain boundary, boundaries between crystals of different phases, the grain size, the effect of grain boundaries on mechanical properties, Hall-Petch relation**.(8)**

Unit 3

Precipitation hardening in alloys: Introduction and significance of the solvus curve, solution and aging treatments, development of precipitates, aging and precipitation sequences of binary and ternary aluminium alloys, homogeneous versus heterogeneous nucleation of precipitates, interphase precipitation, theories of hardening, additional factors in precipitation hardening **(6)**

Unit 4

Conventional and advanced Engineering Materials: Alloying of steel, properties of stainless steel and tool steels, maraging steels, copper and copper alloys, cupronickel, aluminium and its alloys, nickel based superalloys and titanium alloys, graphene, carbon nanotubes (CNT), buckminsterfullerene (C60), introduction to smart materials and their applications. **(10)**

Unit 5

Metallography and Characterization Techniques: Introduction, metallurgical microscope, preparation of specimen, micro and macro examination, the Bragg law, Laue techniques, the rotating-crystalmethod,the Debye-Scherrer or powder method, the x-raydiffractometer (XRD), scanning electron microscope (SEM) and its working principle, transmission electron microscope (TEM) and its working principle. **(10)**

Recommended/ Reference Books:

1. Material Science and Engineering-An Introduction: Callister, W.D., John Wiley & Sons, Delhi
2. Physical Metallurgy Principles- by Reza Abbaschian, Lara Abbaschian and Robert E. Reed-Hill - Cengage Learning
3. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi
4. Engineering Metallurgy (Part I: Applied Physical Metallurgy): Raymond A. Higgins, Arnold Publishers
5. Physical Metallurgy, 4th ed. Vol.1:Robert W. Cahn, Peter Haasen, North-Holland Publishers
6. Physical Methods for Materials Characterisation: P E J Flewitt, R K Wild, Institute of Physics Publishing

Weblinks:

1. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/courses/113/106/113106034/
3. https://nptel.ac.in/courses/113/102/113102080/
4. https://nptel.ac.in/courses/112/108/112108150/
5. https://nptel.ac.in/courses/113/106/113106032/
6. https://nptel.ac.in/courses/113/105/113105023/

PEC-ME-726/21 COMPOSITE MATERIALS (PEC-IV)

B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Materials Engineering

Successive: Manufacturing Technology

Course Objectives:

The objective of this course is to provide the students an understanding of composite materials along with their processing methods and mechanical behavior.

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

CO 1-Classify composite materials and describe their mechanical behavior.

CO 2-Describe manufacturing techniques of composite materials.

CO 3-Determine stresses in composite laminates based on various theories of failures.

CO 4-Analyze the laminated plates under different application conditions.

Course Contents:

Unit 1

Definition and applications of composite materials: Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke;s law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness. **(10)**

Unit 2

Manufacturing of composite materials: bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes. **(10)**

Unit 3

Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai- Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates. **(10)**

Unit 4

Analysis of laminated plates: equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies. **(10)**

Recommended/ Reference Books:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill, 1994.

2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill, 1998.

Web Links:

S.N	Address of web source	Content
1.	https://youtu.be/PzdCymgyZ6c	Basics of Composite Materials
2.	https://youtu.be/qloBacY7MRw	Stress and Strain Transformations
3.	https://youtu.be/XRxDpK5-GgY	Quasi- Isotropic Laminates
4.	https://youtu.be/TWyJmrueMew	Governing Equations for Composite Plates
5.	https://youtu.be/2LPapFKRxTI	Thermal Effects in Composite Laminates
6.	https://youtu.be/ko-bxZkxOX0	Buckling of Composite Plates

PEC-ME-727/21 MODELING, SIMULATION AND OPTIMIZATION (PEC-IV)

B. Tech (Mechanical Engineering) VII/VIII Semester

No. of Credits: 3 Sessional: 25 Marks

L	T	P	Total
3	0	0	3

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

Pre- Requisite: Operation Research

Successive: Nil

Course Objectives:

The objective of this course is to understand the use of design techniques for optimization.

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

CO 1- Describe design optimization using simulation.

CO 2- Illustrate different approaches for optimization.

CO 3- Learn different optimization techniques.

CO 4- Apply optimization techniques in mechanical design.

CO5- Describe applications of optimization with respect to functionality; Asthetics, Economics & materials.

Course Contents:

Unit 1

Introduction: Simulation models, purpose of simulation, advantages and disadvantages, simulation issues, Problem formulation: formal problem statement, orientation, project objectives, simulation project manager functions, developing simulation project plan, Gantt chart, introduction to project management softwares, System classification: chart basics, high level flow chart, data to be included in the model, output data and summary. **(5)**

Unit 2

Data collection and analysis: Introduction, data sources and collection, data types, input data distribution, analyzing input data, software usage for data fitting, model translation: simulation program selection, model translation section content, model verification: divide and conquer approach, animation, simulation clock advancing, writing output files, model verification: need and types, face and statistical validity, validation data analysis process **(8)**

Unit 3

Experimental design and analysis: Introduction, factors and levels, N- factors factor experimental designs, 2k experimental designs, refining the experimental alternatives, terminating and non-terminating system analysis, written report guidelines, presentation guidelines, presentation media, electronic presentation software issues. **(6)**

Unit 4

Training simulators and case studies: Introduction, simulation process planning, modeling, verification and implementation, introduction to ARENA, AutoMod, AutoStat, SIMPAK, case studies **(8)**

Unit 5

Optimization techniques: Introduction to optimization, steps of design optimization, classical methods of optimization, non-conventional design optimization techniques like genetic algorithms, simulated annealing and other techniques. **(6)**

Unit 6

Optimization Techniques Applications: Mechanical system design optimization techniques, optimal selection of materials and processes, human safety and professional ethics, aesthetics and ergonomics in design optimization, advances in design optimization, case studies **(7)**

Recommended/ Reference Books:

1. H. Adeli. Advances in Design Optimization.
2. Simulation modelling handbook: Christopher A. Chung, CRC Press
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

Web Links:

S.N	Address of web source	Content
1.	https://youtu.be/xOf95A5Sk94	Design Prototyping
2.	https://youtu.be/rnVf5mbTNa8	Generic Phases of Design
3.	https://youtu.be/iRbMIt1LBaw	Configurational Design Aspects
4.	https://youtu.be/0tfCRqrcl7s	Concurrent Engineering Approaches
5.	https://youtu.be/hI0NXPKuPnM	Product Development Methodology
6.	https://youtu.be/enDpEQGwtq8	Materials Selection In Engineering Design- I
7.	https://youtu.be/1xBWM0OhGh4	Materials Selection In Engineering Design-II
8.	https://youtu.be/NppPm4efsA8	Basic Steps in the Material Selection Process

PEC-ME-741/21 MARKETING MANAGEMENT (PEC-V)
B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Industrial Engineering

Successive: Nil

Course Objectives:

The objective of this course is to familiarize the students with the basics of marketing management.

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

CO1- Describe the role of marketing management in industries.

CO2- Understand role of marketing strategies.

CO3- Recognize the role of consumer behaviour.

CO4- Illustrate the various aspects of managing a product.

CO5- Demonstrate the administration of marketing programmes.

CO6- Conceptualize digital marketing in modern era.

Course Contents:

Unit 1

Introduction to Marketing Management: genesis of marketing concept; Needs, wants, demand, segmentation, brands, marketing channels, Environment of Marketing- Economic Environment, Socio cultural environment. Legal Environment. **(7)**

Unit 2

Marketing Strategy: Marketing and customer value, planning, marketing organisations, the concept of marketing mix, forecasting. **(5)**

Unit 3

Consumer Behaviour: Meaning, Definition, Variables and Factors affecting Consumer Behaviour. Buying Motives: Meaning, Kinds, Chief Buying Motives, Different Types of Consumers, Behaviour and Customer Service. **(8)**

Unit 4

Product Management: Product policy; the concept of product life cycle. New product decisions. Test marketing- Pricing Management of distribution: channels of distribution, Brand of produc.t **(8)**

Unit 5

Implementation and Control: Administration of the marketing programme, Advertising and production, managing retailing, wholesaling and logistics, control of marketing effort; marketing audit, sales analysis. **(8)**

Unit 6

Managing Digital Communication: Online marketing, advantage disadvantage, Managing personal communication. **(6)**

Recommended/ Reference Books:

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

Web Links:

S.N	Address of web source	Content
1	https://nptel.ac.in/courses/110/104/110104068/	Marketing, Marketing concept, marketing strategy, marketing mix, Market segmentation, test marketing, consumer buyer, socio cultural environment
2	https://nptel.ac.in/courses/112/107/112107217/	Product policy, Product life cycle, New Product decision
3	https://www.youtube.com/watch?v=bH94eTQLs5g	Sales forecasting
4	https://www.youtube.com/watch?v=7Hphv79OZJY	Qualitative method
5	https://www.youtube.com/watch?v=wKXJ5Cj5QT4	Quantitative method
6	https://www.youtube.com/watch?v=LU-5iDyyqVI	Quantitative method
7	https://www.youtube.com/watch?v=N1_IpX9zZFo	Marketing Audit

PEC-ME-742/21 PROCESS PLANNING AND COST ESTIMATION (PEC-V)

B. Tech (Mechanical Engineering) VII/VIII 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:

The objective of this course is to introduce process planning concepts to make cost estimation for various products .At the end of course, the students will be able to:

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

CO1- Understand the basic concepts of process planning.

CO2- Gain knowledge about the various activities involved in process planning.

CO3- Evaluate about the cost estimation and its procedure

CO4- Understand the machining time of different machines

Course Contents:

Unit 1

Introduction of Process Planning- methods of process planning, , material evaluation, steps in process selection, production equipment and tooling selection. **(8)**

Unit 2

Process planning activities- process parameter calculation for various production processes, selection of jigs and fixtures, selection of quality assurance methods, documents for process planning. **(8)**

Unit 3

Introduction to cost estimation importance of costing and estimation, methods of costing, elements of cost estimation, types of estimates. **(7)**

Unit 4

Estimating procedure, estimation of labor cost, material cost, allocation of overhead charges, calculation of depreciation cost, cost of conversion. **(10)**

Unit 5

Calculation of machining time for different machines such as lathe, drilling, Milling, shaping , grinding. **(8)**

Unit 6

Estimation of forging cost, estimation of welding cost, estimation of foundry cost, estimation of machining cost. **(8)**

Recommended/ Reference Books:

1. Process Planning, Design/ Manufacture Interface, by Peter Scalon, Elsevier publication,
2. Manufacturing Processes and Systems, by Ostwaal , John Wiley , Publication
3. Product Design and Manufacturing, by R.C Gupta, Prentice Hall Publication

Website link

S.N	Website link	Content covered
1	https://easyengineering.net/process-planning-and-cost-estimation-by-jayakumar/	UNIT 1,2,3
2	"https://www.youtube.com/embed/ddvMPpJnwTM"	Unit 4
3	"https://www.youtube.com/embed/xLFSKrDcZ40"	Unit 5,6

PEC-ME-743/21 QUALITY MANAGEMENT SYSTEMS (PEC-V)
B. Tech (Mechanical Engineering) VII/VIII Semester

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

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

Pre- Requisite: Industrial Engineering

Successive: Nil

Course Objectives:

The objective of this course is to understand the concept of quality management and process/ quality improvement techniques.

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

CO 1- Understand various aspects of Quality Management and Quality Assurance .

CO 2- Utilize various process quality improvement tools.

CO 3- Analyze quality related problems and develop suitable control charts for its remedy.

CO 4- Apply sampling method to check the quality of a product lot.

CO 5- Understand contemporary trends in Quality Engineering & Management.

Course Contents:

Unit 1

Introduction: Evolution of Quality Management, Concepts of Product and Service Quality, Quality Guru's, Quality Awards, Quality Cost. **(8)**

Unit 2

Quality Assurance: Inspection, Quality control, Quality assurance, Concept and Advantage of quality assurance, Quality rating, Quality survey/audit, Vendor rating, Quality function deployment, cost of poor quality, companywide quality control. **(6)**

Unit 3

Process Quality Improvement: Introduction to process quality, Graphical and statistical techniques for process quality improvement, Graphical tools for data representation, 7QC tools, Process capability analysis. **(6)**

Unit 4

Acceptance Sampling: Concept of acceptance sampling, advantage and limitations of sampling inspection, Industrial uses of acceptance sampling, OC curve, producer and consumer risk, Quality indices for acceptance sampling plans, Average outgoing quality limit, sampling plans. **(8)**

Unit 5

Control Charts: Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables - $\bar{x}$ and R charts, attribute control charts - p, np, c and u-Construction and application**. (8)**

Unit 6

Contemporary Trends in Quality Engineering & Management: Introduction to Quality Management Standards – ISO 9000, ISO 14001, Six sigma (introduction, basic steps involved), Introduction to Japanese's quality techniques such as 5S, Kaizen, TQM, TPM, KANBAN, Gemba. **(8)**

Recommended/ Reference Books:

1. Quality Management by Kanishka Bedi, Pearson Education.

2. Statistical Quality control by Grant and Leavenworth, Tata Mcgraw Hill.

3. Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) by K C Jain and A K Chitale, Khanna Publishers.

4. Total Quality Management by Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield and Mary Besterfield-Sacre, Pearson Educaiton.

5. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.

Web Links:

S.No	Address of web source	Content
1	https://nptel.ac.in/courses/110/104/110104080/	Quality
2	https://nptel.ac.in/courses/110/104/110104080/	Quality Assurance
3	https://nptel.ac.in/courses/110/104/110104080/	7QC tools
4	https://nptel.ac.in/courses/110/104/110104080/	Acceptance Sampling
5	https://nptel.ac.in/courses/110/104/110104080/	Control Charts
6	https://nptel.ac.in/courses/110/104/110104080/	Six Sigma

PEC-ME-744/21 POWER PLANT ENGINEERING (PEC-V)
B. Tech (Mechanical Engineering) VII/VIII 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: Applied Thermodynamics

Successive: Nil

Course Objectives:

The objective of this course is to provide an overview of power plants and the associated energy conversion processes.

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

CO1- Describe the essentials of the power plant.

CO 2- Explain the thermal power plants.

CO 3-Describe the renewable energy based power plants.

CO 4-Analyze the economical and environmental issues related with the power plants.

Course Contents:

Unit 1

Introduction: Different types of power plants, Thermodynamics related to power plants, different types of fuels related to power plants, Availability based tarrif (ABT), boiler safety act, comparative study of different types of power plants. **(04)**

Unit 2

Coal Based Power Plants:

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, Pinch point analysis, Wilson line, subsystems of coal based power plants, Steam turbines, condensers, steamandheating rates, fuel and ash handling, electro-static precipitator (ESP), draught system,feed water treatment, binary cycles and cogeneration systems. **(08)**

Unit 3

Gas turbine and Combined Cycle Power Plants:

Gas turbine based combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, heat recovery steam generator (HRSG), Coal gasification, Integrated Gasifier based Combined Cycle (IGCC) systems. **(06)**

Unit 4

Nuclear Power Plant:

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.**(06)**

Unit 5

Renewable Energy:

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.**(06)**

Unit 6

Power Plant Analysis:

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.**(06)**

Recommended/ Reference Books:

1. Nag P.K., Power Plant Engineering, Tata McGraw Hill.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, McGraw Hill.

PEC-ME-745/21 ENERGY CONSERVATION AND MANAGEMENT (PEC-V)

B. Tech (Mechanical Engineering) VII/VIII 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: Applied Thermodynamics

Successive: Nil

Course Objectives:
The objective of this course is to understand 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 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:

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. **(10)**

Unit 2

Components of energy systems:

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. **(10)**

Unit 3

Power plant efficiency improvement:

Efficiency improvement of thermal systems, methods to improve efficiency of different components of thermal systems such as Boilers, Furnaces. Steam distribution and usage in power plants,steam traps, condensaterecovery, flash steam utilization; Insulation & Refractories for energy conservation. **(8)**

Unit 4

RAC efficiency improvement:Analysis of different components of RAC systems e.g. pumps, fans, blowers, compressors, condensers evaporators, Cooling Towers. VRF and VRV air conditioning, chillers**. (6)**

Unit 5

Energy Economics and green building: Discount period, payback period, internal rate of return, net present value, Life Cycle costing- ESCO concept.Green building concept, energy conservation in green building, pay-back period analysis of green buildings. **(6)**

Recommended/ Reference 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).

Web Links:

S.N	Address of web source	Content
1	www.energymanager training.com	Unit 1
2	http://www.nptel.ac.in	Unit 3, Unit 4

PEC-ME-746/21 MICRO AND NANO MANUFACTURING (PEC-V)

B. Tech (Mechanical Engineering) VII/VIII Semester

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

Pre- Requisite: Material Science, Physics

Successive: None

Course Objectives:

The objective of this course is to familiarize the students with the processes and techniques of micro and nano manufacturing.

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

CO 1- Understand the synthesis and processing at micro and nano scale.

CO 2- Describe the micro-manufacturing techniques and related instrumentation.

CO 3 Discuss the nanofabrication techniques and nanomaterials.

CO 4 Distinguish between various non-conventional micro-nano manufacturing processes.

CO 5- Classify methods for surface and structural characterization of materials.

Course Contents:

Unit 1

Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology.

Nano materials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of nanomaterials- solgel process, Liquid solid reactions; Gas Phase synthesis of nanomaterials- Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing(GPC), Chemical Vapour Condensation(CVC)- Cold Plasma Methods, Laser ablation, Vapour – liquid –solid growth, particle precipitation aided CVD, summary of Gas Condensation Processing (GPC). **(7)**

Unit 2

Micro-manufacturing Techniques: Introduction to micromachining, Micro drilling – process, tools and applications Micro turning- process, tools and applications, Diamond Micro turning – process, tools and applications Micro milling and Micro grinding – process, tools and applications Micro extrusion- process and applications Nano- Plastic forming, Laser technology in micro manufacturing-

Practical Lasers, application of technology fundamentals, Bulk Micromachining, Surface Micromachining, High- Aspect-Ratio Micromachining. Micro instrumentation – applications. **(7)**

Unit 3

Nanofabrication Techniques: Introduction to Nanofabrication, Nanofabrication using soft lithography – principle, applications – Examples (Field Effect Transistor, Elastic Stamp) Introduction to Carbon nano-materials – CN Tubes CN Tubes – properties and applications CN Tube Transistors – Description only CVD Diamond Technology, LIGA Process, Nano-finishing operations. **(6)**

Unit 4

Introduction to Non-conventional micro-nano manufacturing Processes: principle and applications – Abrasive Jet Micro Machining, WAJMM Micro EDM, Micro WEDM, Micro EBM – Process principle, description and applications Micro ECM, Micro LBM - Process principle, description and applications Focused ion beams - Principle and applications. **(7)**

Unit 5

Structural Characterization: X-ray diffraction, Small angle X-ray Scattering, Optical Microscope and their description, Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM).

Spectroscopic characterizations: Basic concepts of spectroscopy, operational principle and application for analysis of nanomaterials, UV-VIS-IR Spectrophotometers, Principle of operation and application for band gap measurement, Raman spectroscopy. **(8)**

Unit 6

Surface Characterization: X-ray Photoelectron Spectroscopy (XPS), Auger electron spectroscopy, Low Energy Ion Scattering Spectroscopy (LEISS), Secondary Ion Mass Spectroscopy (SIMS), Rutherford Backscattering Spectroscopy (RBS).

Thermal Characterization of Nanomaterials: DTA, TGA, DSC (Principle and Applications), Determination of thermo-physical parameters. **(5)**

Recommended/Reference Books:

1. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press.

2. Gabor L. Hornyak, H.F Tibbals, Joydeep Dutta & John J Moore, Introduction to Nanoscience and Nanotechnology, CRC Press.

3. V.K.Jain, Micro-manufacturing Processes, CRC Press,

4. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer.
5. Robert F Speyer, Thermal Analysis of Materials, Marcel Dekker Inc, New York.
6. B.D. Cullity - Elements of X-Ray Diffraction, 3rd edition, Prentice Hall.

PEC-ME-747/21 FINITE ELEMENT ANALYSIS (PEC- V)

B. Tech (Mechanical Engineering) VII/VIII 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:

The objective of this course is to introduce the concepts of Mathematical Modeling of Engineering Problems and to appreciate the use of FEM to a range of Engineering Problems.

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

CO 1- Uunderstand Different mathematical Techniques used in FEM analysis use of them in Structural and thermal problems.

CO2- Analyze one dimensional problems in FEM.

CO3- Formulate and solve two dimensional scalar and vector variable problems.

CO4- Formulate Isoparametric problems.

Course Contents:

Unit 1

Introduction: Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – RitzTechnique – Basic concepts of the Finite Element Method.

Unit 2

One-Dimensional Problems: One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

Unit 3

Two Dimensional Scalar Variable Problems: Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.

Unit 4

Two Dimensional Vector Variable Problems: Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

Unit 5

Isoparametric Formulation: Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

Recommended/Reference Books:

1. Reddy. J.N., "An Introduction to the Finite Element Method", Tata McGrawHill,
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, www.padeepz.net www.padeepz.net
3. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann
4. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd.,
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis, Wiley Student Edition.
6. Chandrupatla&Belagundu, "Introduction to Finite Elements in Engineering, Edition, Prentice Hall College Div.
7. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons,

Web Links:

S.N	Address of web source	Content
1.	https://youtu.be/UOp6JEiJctA	Introduction to Finite Element Analysis
2.	https://youtu.be/0VNIEfX0m4A	Nodes, Elements and Shape Functions
3.	https://youtu.be/pB9DqY1bYtk	Errors in FEA, Overall FEA Process
4.	https://youtu.be/W4wIJfRPR5U	Functionals used in FEA
5.	https://youtu.be/rFztdZ7-b2M	Rayleigh- Ritz Method
6.	https://youtu.be/IokLU-L6Al4	1-D Heat Conduction

OPEN ELECTIVES COURSES
OFFERED BY
OTHER DEPARTMENTS

COURSES OFFERED BY COMPUTER ENGINEERING AND INFORMATION TECHNOLOGY DEPARTMENT

(OPEN ELECTIVE COURSES-1) (OEC-1)

OEC-ME- 501 INTELLIGENT SYSTEMS

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 understand the principles of intelligent systems and application to the functioning of an Organization.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO1- To understand of Principle of Intelligent Systems
CO 2- Understanding of Knowledge Presentation
CO 3- Familiarisation of risk in uncertainty.
CO 4- To know Controlling strategies.

Unit 1

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 2

Heuristic Search Techniques: Generate & Test, Hill Climbing (simple &stipest), Best first search, A*, AO*, Constraint Satisfaction.

Unit 3

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 4

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 5

Planning & Learning : Planning, Planning in Situational calculus ,Representation for planning ,Partial order palnning, Partial order palnning algorithm, Learning by Examples, Learning by Analogy, Explanation based learning, Neurals nets, Genetics algorithms

Unit 6

Minimax: Game playing strategy, Natural language processing ,Overview of linguistics, Grammer & Language, Transformation Grammer, Basic Parsing Techniques, Expert System, Architecture of Rule based Expert system ,Non Rule based Expert system.

Recommended/Reference Books:

1. Artificial Intelligence by Elain Rich & Kevin Knight, Tata McGraw Hills Pub.
2. Principals of AI by Nills .J.Nilsson, Pearson Education Pub.
3. Artificial Intelligence by DAN. W.Petterson. Printice Hall of India
4. Artificial Intelligence by Petrick Henry Winston,
5. Artificial Intelligence by Russel and Norvig, Pearson Education Pub.

OEC-ME-502 CYBER LAWS AND SECURITY

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

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

Course Objectives:
To understand the principles of Cyber Laws and
Security and application to the functioning of an Organization

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

1. To understand of Principle of Information Systems
2. Understanding of Knowledge Security Threats
3. Familiarisation of Model of Cryptographic Systems
4. To know Security metrics

UNIT IHistory of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.

UNIT II Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges

UNIT III Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN

UNIT IV Security metrics- Classification and their benefits Information Security & Law, IPR, Patent Law, Copyright Law, Legal Issues in Data mIning Security, Building Security into Software Life Cycle Ethics- Ethical Issues, Issues in Data and Software Privacy Cyber Crime Types & overview of Cyber Crimes

References:

1. Godbole,“ Information Systems Security”, Willey
2. Merkov, Breithaupt, “ Information Security”, Pearson Education
3. Yadav, “Foundations of Information Technology”, New Age, Delhi
4. Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill
5. Sood,“Cyber Laws Simplified”, Mc Graw Hill
6. Furnell, “Computer Insecurity”, Springer 7. IT Act 2000

OEC-ME-503 SOFT COMPUTING

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 understand the principles of Soft Computing
Security and application to the functioning of an Organization

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

1. Understand of Principle of I Neural Networks
2. Understand of Fuzzy Sets
3. Familiarise of Model of Operations on Fuzzy Sets
4. know Fuzzy Logic:

UNIT I **Neural Networks:** History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms- Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms- perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perception Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

UNIT II **Fuzzy Logic:** Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

UNIT III Operations **on Fuzzy Sets:** Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

UNIT IV **Fuzzy Arithmetic:** Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT V **Fuzzy Logic:** Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Genetic Algorithms, Scope & application areas, solution of 0-1Knapsack problem using GA

References:

1. “Fuzzy sets and Fuzzy Logic: Theory and applications”,G.J. Klir,B.Yuan, PHI

2. “Introduction to Fuzzy sets and Fuzzy Logic”, M.Ganesh , PHI

3. “An Introduction to Fuzzy Control”, D Driankov, H Hellendoorn, M Reinfrank, Narosa Publishing Company

4. “Neural Networks: A classroom approach”, Satish Kumar , Tata McGraw Hill

5. Haykin S., “Neural Networks-A Comprehensive Foundations”, Prentice-Hall International, New Jersey, 1999.

OEC-ME-504 WEB TECHNOLOGY AND INFORMATION RETRIEVAL

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 understand the principles of Web Technology And Information Retrieval

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

1.Understandof Principle of I Neural Networks
2. Understanding of Web Search Basics
3. Familiarise of Web Crawlers
4. know Information Retrieval
5 understand Index Construction

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.

OEC-ME-505 INTELLECTUAL PROPERTY RIGHTS

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 understand the principles of intellectual property rights.

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

1. Explore Principle of Intellectual Property
2. Expedite Introduction to Patents
3. Familiarise of Compulsory License
4. Know Infringement

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.

COURSES OFFERED BY CIVIL ENGINEERING DEPARTMENT (OPEN ELECTIVE COURSES-1) (OEC-1)

OEC-ME-506 BASIC ENVIRONMENTAL 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 Objectives: This course is designed to enable a better understanding of human impact on our surroundings and the environmental needs of the future.

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

CO1- Study a variety of topics that include: biotic and abiotic factors in habitats; ecosystems and biomes;

CO2 – Understand interrelationships among resources and an environmental system;

CO3 – Understand sources and flow of energy through an environmental system;

CO4 – Establish relationships between carrying capacity and changes in populations and ecosystems.

Course Contents:

UNIT 1: Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes

UNIT 2: Sewage- Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

UNIT 3: Air - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution,

Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations

UNIT 4: Noise- Basic concept, measurement and various control methods.

UNIT 5: Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methodsIntegrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

UNIT 6: Building Plumbing-Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.

Text/Reference Books:

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.

2. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.

3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.

4. MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.

5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.

6. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999

7. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication

8. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

OEC-ME- 507 TRAFFIC ENGINEERING AND MANAGEMENT

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 OUTLINE: Traffic engineering and management is a first level post graduate course in Transportation Systems Engineering. The course introduces the concepts of characterizing traffic, various modeling approaches, and design of facilities to control and manage traffic. The course is designed in a modular fashion so that each module will introduce the underlying principles, current practice, ample numerical illustrations, and few case studies of broad areas of the subject. The modules are sequenced in such a way that the course first introduces simple, but fundamental characteristics of traffic and move gradually to complex traffic management concepts. The last module is devoted for advanced and specialized traffic facilities.Although the major focus of the course is urban vehicular traffic, some effort is taken to show how these lessons can be applied to other modes as well. A key feature of the course is that it is well knit with the current design and analysis practice stipulated in both national and international codes, standards, and manuals.

UNIT 1: Contents: Traffic stream characteristics; Traffic measurement procedures; Microscopic traffic flow modeling; Macroscopic and mesoscopic traffic flow modeling; Uninterrupted flow; Traffic intersection control; and Traffic impact studies.

UNIT 2: Traffic stream characteristics: Introduction to traffic engineering: Road user characteristics, human and vehicle characteristics; Fundamental parameters and relations of traffic flow: speed, density, volume, travel time, headway, spacing, time-space diagram, time mean speed, space mean speed and their relation,relation between speeds, flow, density, fundamental diagrams; Traffic stream models: Greenshield's model, Greenberg's logarithmic model, Underwood's exponential model, pipe's generalized model, multi-regime models; Moving observer method: Concepts and derivation, illustration, Calibration of Greenshild's model.

UNIT 3: Traffic measurement procedures: Measurement at a point: Traffic volume measurement, equipment for flow measurements, data analysis, concepts ofADT,AADT; Measurement over a short section:Speed measurements, 15th and 85th percentile speeds, design speed,

speed distributions; Measurement along a length of road: Density measurement, travel time measurement; Automated traffic measurement: GPS devices, loop detectors, video analysis, and other technologies.

UNIT 4: Microscopic traffic flow modelling: Car-following models: Concept of stimulus-response, general mottoes models, safety distance, pscho-physical, optimal velocity, fuzzy logic models, and applications; Lane changing models: Conceptual framework, lane selection model, gap acceptance models;model, gap acceptance models; Vehicle arrival models: Poisson distribution, headway modeling, random vehicle generation; Microscopic traffic simulation:Vehicle generation, design, calibration, validation, applications, operational models

UNIT 5: Macroscopic and mesoscopic traffic flow modelling: Traffic flow modeling analogies: Fluid flow analogy, heat flow analogy, granular flow, Lighthill-Withams theory, shock waves; Cell transmission models: Flow conservation, flow transmission; Traffic progression models: Robertson progression model, platoon movement, dispersion index, applications; Discrete simulation models: Cellular automata concepts, discretization of time and space,rules for acceleration, deceleration, randomization, and vehicle updation.

UNIT 6: Uninterrupted flow: Capacity and Level of service LOS: Definitions, highway capacity, factors affecting LOS, HCM methods; Urban Street: Classification, operational performance measures, congestion management; Multilane highways: Characteristics, capacity and level of service; Freeway operations: Operational considerations, capacity and level of service of a basic freeway segment, weaving operation; Ramp metering: Merging and diverging areas; gap acceptance, speed at ramps; fixed, reactive, and predictive systems; Corridor analysis: Segment capacity, free flow travel time, queue delay, transit corridor.

References:

1. Roess, RP., McShane, WR. and Prassas,ES.(1998), Traffic Engineering,Prentice Hall.
2. May,A. D.(1990), Fundamentals of Traffic Flow,Prentice Hall.
3. Papacostas, C.S.(1987), Fundamentals of Transportation Engineering,Prentice Hall.
4. Kadiyali, LR (1987), Traffic Engineering and Transportation Planning,Khanna.
5. Highway Capacity Manual (2000), Transportation Research Board, USA.
6. Khanna,S.K. and Justo, C.E. G.(1991), Highway Engineering, Nemchand.

OEC-ME-508 CONTRACTS MANAGEMENT

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: This course will enable students to:

• Understand the various types of contracts

• Understand the use and effect of contracts in construction industry

UNIT 1: Introduction to contracts: Definitions, Essentials for a legally valid contract, Salient features of contract, Discharging of a contract, Documents for an Engineering Contract; Types of contracts: Classification Based on − Tendering Process, Economic Consideration, Applicability of the various types of contracts in Construction.

UNIT 2: Tendering process: Definitions, List of Documents, EMD, Security Deposit, Invitation for Tenders and sale of Documents, Preparation of Tender Documents and its submission, Receipt of Tender Documents and its opening, Evaluation of Tender and Award of contract – Letter of Award, Letter of Intent, Issues in tendering process: Pre - Registration, Pre – Qualification, Nominated Tendering, Rejection of Tenders, Repeat Orders, Revocation of Tenders, Unbalanced Bidding

UNIT 3: Administration/Performance of contract: Responsibilities (Duties and Liabilities) of Principal & Contractor, Monitoring and Quality control/assurance, Settlement of claims − Advances, Bills, Extension for time, Extras & Variations, Cost Escalations. Security Deposit, Retention Money, Performance Bond, Liquidated Damages, Penalties, Statutory Requirements.

UNIT 4: Breach of contract: Definition and Classification, Common Breaches by – Principal, Contractor, Damage Assessment, Claims for Damages.

UNIT 5: Dispute resolution: General, Methods for dispute resolution − Negotiations, Mediation, Conciliation, Dispute Resolution Boards, Arbitration, Litigation/Adjudication by courts. Conciliation − Appointment of Conciliator, Role of Conciliator, Special Features of Conciliation Dispute Resolution Boards (DRB) − Constitution Of DRB, Functioning of DRB, Procedure for Hearings, Status of Award.

REFERENCES:

1. Vaid K.N., (1998)"Global perspective on International Construction Contracting Technology and Project Management", NICMAR, Mumbai

2. Prakash V. A.,(1997) “Contracts Management in Civil Engineering Projects”, NICMAR

3. Patil B. S.,(2009) “Civil Engineering Contracts and Estimates”, University Press.

4. John G. Betty(1993/ Latest Edition) “Engineering Contracts”, McGraw Hills.

5. Vasavada B. J.,(1997), “Engineering Contracts and Arbitration”, (Self Publication by JyotiB.Vasavada).

6. Albett Robert W., (1961/ Latest Edition) "Engineering Contracts and Specifications”, John. Willey and Sons, New York.

OEC-ME-509 SOLID AND HAZARDOUS WASTE MANAGEMENT

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 Objective:

This course provides an in depth understanding of solid and hazardous waste characteristics and management. Some basics of radioactive waste characterization and handling are also provided.

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

CO1- Learn comprehensive overview of solid, biomedical and hazardous wastemanagement.

CO2 - Have knowledge on solid waste management designaspects.

CO3 - Learn about the different methods of solid wastemanagement.

Course Contents:

UNIT 1: Contents: Solid Waste analysis and characterization, Hazardous waste Characterization Environmental legislation for solid and hazardous waste disposal and transport Risk Assessment, Waste minimization and resource recovery, Waste stabilization techniques, Chemical, physical and biological treatment Landfill design for Sanitary and Hazardous Wastes, Incineration.

UNIT 2: Relevant Regulations Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules

UNIT 3: Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options

UNIT 4: Hazardous Waste Management – Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects

UNIT 5: Radioactive Waste Management – Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options

UNIT 6: Environmental Risk Assessment Defining risk and environmental risk; methods of risk assessment; case studies. Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapour extraction, air stripping, chemical oxidation); ground water contamination and remediation

UNIT 7: Biological Treatment of Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation

UNIT 8: Landfill design Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

References:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.

2. LaGrega, M. D. Buckingham, P. L. Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.

3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.

OEC-ME-510 AIR AND NOISE POLLUTION AND CONTROL

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 Objective: This course provides a comprehensive overview of air and noise quality and the science and technology associated with the monitoring and control

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

CO1 - Identify the sources of air and noise pollution

CO2 - Monitor the ambient air quality

CO3 - Understand the concepts involved in control technologies.

Course Contents:

UNIT 1: Air pollution: composition and structure of atmosphere, global implications of air pollution. Classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photo chemical oxidants. Indoor air pollution,Effects of air pollutants on humans, animals, property and plants.

UNIT 2: Air pollution chemistry, meteorological aspects of air pollution dispersion; temperaturelapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

UNIT 3: Ambient air quality and standards, air sampling and measurements; Ambient air sampling,collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Control devices for particulate contaminants: gravitational settling chambers, yclonee separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

UNIT 4: Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion,Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydro carbons.Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-IIIspecifications, Indian specifications.

UNIT 5: NOISE POLLUTION: Basics of acoustics and specification of sound; sound power, soundintensity and sound pressure levels; plane, point and line sources, multiple sources; outdoorand indoor noise propagation; psycho-acoustics and noise criteria, effects of noise onhealth, annoyance rating schemes; special noise environments: Infra-sound, ultrasound,impulsive sound and sonic boom; noise standards and limit values; noise instrumentationand monitoring procedure. Noise indices.

Recommended/ Reference Books:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Warkand Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Keshav Kant and Rajni Kant, "Air Pollution and Control Engineering", Khanna Publishing House.
6. Environmental Pollution Control Engineering-CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
7. C.S. Rao, Air pollutionand control
8. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987
9. Nevers: Air Pollution Control Engineering.
10. M. P. Poonia and S C Sharma," Environmental Engineering, Khanna Publishing House.
11. My cock, Mc Kenna and Theodore: Handbook of Air Pollution Control Engineering and Technology. Suess and Crax ford: W.H.O. Manualon Urban Air Quality Management
12. O.P. Gupta, Elements of Environmental Polluton Control, Khanna Publishing House.

COURSES OFFERED BY ELECTRICAL ENGINEERING DEPARTMENT

(OPEN ELECTIVE COURSES-OEC-II)

ELPE411	Electrical Energy Conservation and Auditing	3L:0T:0P	3 credits

Course Outcomes:

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

1. Understand the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy management.
3. Understand the methods of improving energy efficiency indifferent electrical systems.
4. Understand the concepts of different energy efficient devices.

Unit 1: Energy Scenario (6 Hours)

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

Unit 2: Basics of Energy and its various forms (7 Hours)

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units andconversion.

Unit 3: Energy Management & Audit (6 Hours)

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Unit 4: Energy Efficiency in Electrical Systems (7 Hours)

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficientmotors.

Unit 5: Energy Efficiency in Industrial Systems (8 Hours)

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.Cooling Tower: Types and performance evaluation, efficient system operation,

flow control strategies and energy saving opportunities, assessment of cooling towers.

Unit 6: Energy Efficient Technologies in Electrical Systems (8Hours)

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

Text/Reference Books

1. Guide books for National Certification Examination for Energy Manager / EnergyAuditors Book-1, General Aspects (availableonline)
2. Guide books for National Certification Examination for Energy Manager / EnergyAuditors Book-3, Electrical Utilities (availableonline)
3. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill,1991.
4. Success stories of Energy Conservation by BEE, New Delhi(www.bee-india.org)

ELPE412	Industrial Electrical Systems	3L:0T:0P	3 credits

Course Outcomes:

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

1. Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbolsand drawings, SLD.
2. Understand various components of industrial electricalsystems.
3. Analyze and selectthe proper size of various electrical systemcomponents.

Module 1: Electrical System Components (8 Hours)
LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Module 2: Residential and Commercial Electrical Systems (8 Hours)
Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Module 3: Illumination Systems (6 Hours)
Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Module 4: Industrial Electrical Systems I (8 Hours)
HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Module 5: Industrial Electrical Systems II (6 Hours)
DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Module 6: Industrial Electrical System Automation (6 Hours)
Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text/Reference Books

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating &Costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.
3. S. Singh and R. D. Singh, “Electrical estimating and costing”, DhanpatRai and Co., 1997. Web site for IS Standards.
4. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.

ELPC502	Control Systems	3L:0T:0P	3 credits

Course Outcomes:

At the end of this course, students will be able to

1. Understand the modeling of linear-time-invariant systems using transfer function and state- space representations.
2. Design specifications for second order systems based on time response.
3. Interpret the Concept of stability and its assessment for linear-time invariant systems using various methods.
4. Design controllers in time and frequency domain.
5. Explain the basic concept of optimal and non linear control systems.

Unit 1: Introduction to control problem (8 hours)

Industrial Control examples, Mathematical models of physical systems, Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback, Transfer Function of control system, impulse response and its relation with transfer function of linear systems. Transfer function from Block diagram reduction technique and signal flow graph, Mason's gain formula.

Unit 2: Time Response Analysis (6 hours)

Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Design specifications for second-order systems based on the time-response. Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci

Unit 3: Frequency-response analysis (6 hours)

Relationship between time and frequency response, Polar plots, Bode plots, Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin, Closed-loop frequency response.

Unit 4: Introduction to Controller Design (10 hours)

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems, Root-loci method of feedback controller design, Design specifications in frequency-domain, Frequency-domain methods of design, Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs, Analog and Digital implementation of controllers.

Unit 5: State Variable Analysis of Linear Dynamic Systems (4 hours)

State variables, State variable representation of system, dynamic equations, merits for higher order differential equations and solution, Concept of controllability and observability and techniques to test them

Unit 6: Introduction to Optimal Control and Nonlinear Control (5 hours)

Performance Indices, Regulator problem, Tracking Problem., Nonlinear system–Basic concepts and analysis

Text/References:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
4. I. J. Nagrath and M.Gopal, "Control Systems Engineering", New Age International, 2009

ELPE612	Electrical and Hybrid Vehicles	3L:0T:0P	3 credits

Course Outcomes:

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

1. Understand the models to describe hybrid vehicles and their performance.
2. Understand the different possible ways of energy storage.
3. Understand the different strategies related to energy storage systems.

Unit 1: Introduction (10 hours)

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Unit 2: Electric Trains (10 hours)

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive- train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit 3: Energy Storage (10 hours)

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

Unit 4: Energy Management Strategies (9 hours)

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

References:

1. C.Mi,M.A.MasrurandD.W.Gao,"HybridElectricVehicles:PrinciplesandApplicationswith Practical Perspectives", John Wiley & Sons,2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: EnergyManagement Strategies", Springer,2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press,2004.
4. T. Denton, "Electric and Hybrid Vehicles", Routledge,2016.

ELPE614	Wind and Solar Energy Systems	3L:0T:0P	3 credits

Course Outcomes:

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

1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Understand the basic physics of wind and solar power generation.
3. Understand the power electronic interfaces for wind and solar generation.
4. Understand the issues related to the grid-integration of solar and wind energy systems.

Unit 1: Physics of Wind Power: (5 Hours)

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Unit 2: Wind generator topologies: (12 Hours)

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Unit 3: The Solar Resource: (3 Hours)

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Unit 4: Solar photovoltaic: (8 Hours)

Technologies-Amorphous, mono-crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit 5: Network Integration Issues: (8Hours)

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Unit 6: Solar thermal power generation: (3 Hours)

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Text / References:

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd.,2005.
2. G. M. Masters, "Renewable and Efficient Electric Power Systems**",** John Wiley and Sons,2004.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill,1984.
4. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd.,2006.

5. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications,2004.
6. J.A.DuffieandW.A.Beckman,"SolarEngineeringofThermalProcesses",JohnWiley&Sons, 1991.

COURSES OFFERED BY ELECTRONICS ENGINEERING DEPARTMENT
(OPEN ELECTIVE COURSES-OEC-II)

OEC-ME-606 MICROPROCESSORS AND INTERFACING

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 introduce the architecture and Operations of 8085 and 8086 microprocessor
- To study the addressing modes, instruction set and programming of 8085 & 8086.
- To introduce the various types of interrupts of 8085 and 8086 microprocessor
- To introduce various peripheral devices (8255, 8254, 8259 and 8257)
- To introduce various methods of interfacing of Peripherals with 8085/8086 microprocessor.

Syllabus

PART A

UNIT 1. ARCHITECTURE OF 8085:

Functional block diagram—Registers, ALU, Bus systems. Pin configuration, Timing and control signals, Machine cycle and timing diagrams. Interrupts—Types of interrupt, interrupt structure.

UNIT 2. PROGRAMMING OF 8085:

Instruction format, Addressing modes, Instruction set. Development of assembly language programs.

PART B

UNIT 3. INTERFACING DEVICES:

(a).The 8255 PPI chip: Architecture, pin configuration, control words, modes and Interfacing with 8085. (b). The 8254 PIC chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.

UNIT 4. INTERRUPT AND DMA CONTROLLER:

(a). The 8259 Interrupt controller chip: Architecture, pin configuration, control words, modes

(b). The 8257 DMA controller chip: Architecture, pin configuration, control words, modes

PART C

UNIT 5. ARCHITECTURE OF 8086:

Functional block diagram of 8086, details of sub-blocks such as EU, BIU, memory segmentation, physical address computations, pin configuration, program relocation, Minimum and Maximum modes of 8086— Block diagrams and machine cycles. Interrupts—Types of interrupt, interrupt structure.

UNIT6. PROGRAMMING OF 8086:

Instruction format, Addressing modes, Instruction set. Development of assembly language programs, Assembler directives.

Course Outcomes:

On successful complete of this course, the students should be able to:

• Understand the architecture and Operations of 8085 and 8086 microprocessor

• Understand the addressing modes, instruction set and programming of 8085 & 8086.

• Understand the various types of interrupts of 8085 and 8086 microprocessor

• Understand various peripheral devices (8255, 8254, 8259 and 8257)

• Understand various methods of interfacing of Peripherals with 8085/8086 microprocessor

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.

2. Advanced Microprocessors and Peripherals by AK Ray & KM Bhurchandi, TMH Publications

REFERENCE BOOKS:

1. Microprocessors and interfacing: Hall; TMH

2. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware& Applications: Triebel & Singh; PHI

3. Microcomputer systems: the 8086/8088 Family: architecture, Programming & Design: Yu-Chang Liu & Glenn A Gibson; PHI. 4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

OEC-ME- 608 DIGITAL SIGNAL PROCESSING

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 introduce the students about various types of signals and their representation.

• To introduce the students about Discrete-Time Systems

• To introduce the students about sampling of signals

• To introduce the students about z-transform and its properties

• To introduce the students about various types of filters and their structures.

• To introduce the students about multirate digital signal processing

SYLLABUS

UNIT 1.

DISCRETE-TIME SIGNALS:

Signal classifications, frequency domain representation, time domain representation, representation of sequences by Fourier transform, properties of Fourier transform, discrete time random signals, energy and power theorems.

UNIT 2.

DISCRETE-TIME SYSTEMS:

Classification, properties, time invariant system, finite impulse Response (FIR) system, infinite impulse response (IIR) system

UNIT 3.

SAMPLING OF TIME SIGNALS:

Sampling theorem, application, frequency domain representation of sampling, reconstruction of band limited signal from its samples. Discrete time processing of continuous time signals, changing the sampling rate using discrete time processing.

UNIT 4.

Z-TRANSFORM:

Introduction, properties of the region of convergence, properties of the Z-transform, inversion of the Z transform, applications of Z-transform.

UNIT 5.

BASICS OF DIGITAL FILTERS:

Fundamentals of digital filtering, various types of digital filters, design techniques of digital filters : window technique for FIR, bi-linear transformation and backward difference methods for IIR filter design, analysis of finite word length effects in DSP,FIR &IIR Filter structure-direct1,direct2,cascade and parallel, Application of DSP.

UNIT 6.

MULTIRATE DIGITAL SIGNAL PROCESSING:

Introduction to multirate digital signal processing, sampling rate conversion, filter structures, multistage decimator and interpolators, digital filter banks.

Course Outcomes:

On successful complete of this course, the students should be able to:

1. Understand about various types of signals and their representation and their implementation on MAT LAB.
2. Understand Discrete-Time Systems, sampling of signals and their implementation on MAT LAB.
3. Understand z-transform, its properties and their implementation on MAT LAB.
4. Understand various types of filters, their structures and their implementation on MAT LAB.
5. Understand multirate digital signal processing multirate digital signal processing

TEXT BOOKS :

1. Digital Signal Processing : Proakis and Manolakis; PHI

2. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH

REFERENCE BOOKS:

1. Digital Signal Processing: Alon V. Oppenhelm;PHI

2. Digital Signal processing(II-Edition): Mitra, TMH

OEC-ME-610 INSTRUMENTATION AND CONTROL

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

UNIT 1.

UNITS STANDARDS AND ERRORS:

S.I. units, Absolute standards (International, Primary, Secondary, and Working standards),True Value, Errors(Gross, Systematic and Random); Static Characteristic of instruments(Accuracy, Precision, Sensitivity, Resolution and threshold)

UNIT 2.

MEASURING INSTRUMENTS:

Construction, Operating principle , torque equation , shape of scale , use as Ammeter or as voltmeter (Extension of range) , use on AC / DC or both , advantages and disadvantages, errors(both on AC/DC)of PMMC types, electrodynamic type, moving iron type(attraction , Repulsion and combined attraction, repulsion types). Hot Wire type and induction type, electrostatic type instruments.

UNIT 3.

TRANSDUCERS:

Transducers Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors.

UNIT 4.

MATHEMATICAL MODELING:

Introduction, Control System, Types of Control Systems, Servo-mechanism, Mathematical Model of a System, Mathematical Modelling of Mechanical Systems, , Mathematical Modelling of Electrical Elements, Analogous Systems, Block Diagram Algebra, Signal Flow Graphs,

UNIT 5. TIME DOMAIN ANALYSIS:

Introduction, Time Response, Standard Test Signals, Transfer Function, S – Plane, First Order System, Time Response of First Order System, Speed of Response, Unit Ramp Response of a First Order System, Second Order System, Impulse Response of Second – Order System, Unit Step Response of a Second Order System, Time Domain Specifications, Steady State Error and Error Constants, Type of Feedback Control Systems, Effect of Adding a Zero to a System.

UNIT 6. Compensation, PID Controller.

TEXT BOOK:

1. A course in Electrical & Electronics Measurements &Instrumentation :A.K .Sawhney; Dhanpat Rai& Sons.
2. Control System Engineering : I.J.Nagrath&M.Gopal; New Age
3. Modern Control Engg : K.Ogata; PHI.

REFERENCE BOOKS.

1. Electronics Instrumentation & Measurement Techniques : Cooper; PHI.

OEC-ME-612 DATA COMMUNICATION AND NETWORKING

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 make students know about the data communication and networking
- To make students know about digital data communication
- To make students know about data Link Control, Link Configurations and Protocol principles
- To provide students mathematical formulations and the derivations of various parameters
- To make students know about Communication Networking Techniques
- To make students know about Computer Communication Architecture and ISDN Networks

Syllabus

Unit 1.

Introduction to Data Transmission: Overview of Data Communication and networking, Analog and Digital Data Transmission, Transmission Impairments, Various Transmission Media, Data Encoding.

Unit 2.

Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Error Detection and correction techniques, Physical interfaces

Unit 3.

Data Link Control: Link Configurations, Protocol principles (Error control, Flow control), Bit Oriented and character oriented protocol, Data link layer services, Link Control.

Unit 4.

Multiplexing: F.D.M. Synchronous TDM, Statistical TDM

Unit 5.

Communication Networking Techniques: Communication Networks, Circuit Switching, Message Switching, Packet Switching, Local Networking Technology, The bus / tree topology, the ring topology, Medium Access control protocols (CSMAlCD, Token ring, FDDI, DQDB).

Unit 6.

Computer Communication Architecture: OSI and TCP/IP Model, Protocol and Architecture, Networking Access protocols, Inter Networking, Transport layer Protocols, Session Service and Protocols, and Presentation! Application protocols

Unit 7.

ISDN Networks: Concepts and Architecture, Protocols

Text Books:

1. William Stallings, "Data and Computer Communication", PHI, 4th Ed.
2. Forouzan, "Data communications and networking", TMH

Reference Books:

1. Andrew Tanenbaum, "Computer Networking", PHI
2. Godbole, "Data communications and network", TMH

Course Outcomes: On successful complete of this course, the students should be able to:

1. Understand about the data communication and networking
2. Understand about digital data communication
3. Understand about data Link Control, Link Configurations and Protocol principles
4. Understand about mathematical formulations and the derivations of various parameters Understand about Communication Networking Techniques
5. Understand about Computer Communication Architecture and ISDN Networking

COURSES OFFERED BY HAS DEPARTMENT
(OPEN ELECTIVE COURSES-OEC-III)

OEC-ME-442 SOFT SKILLS FOR ENGINEERS

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 (CO):

1. To equip students with the ability to handle corporate interaction and business communication well by making them conversant with various forms and norms of formal communication.
2. Furthermore, the objective is to guide the students to use communication for leadership and team-building.
3. Ultimately, to convey an idea about operation of social responsibility models and international bodies that bring technology to the service of society, thus, giving our students an ability to discuss larger issues pertaining to technological progress.
4. Since the urge to convey emerges in chosen area of interest and social concerns-emergent issues in science form the basis for interpersonal discussions and soft skills development.

Unit-I-

CRITICAL THINKING & BEHAVIORAL SKILLS: Importance of Scientific Aptitude; SWOC & STEP; Scientific Temper; Logical Fallacies; Positive Attitude, Problem Solving Skills; Ways to Argue Politely; Group Discussions, Corporate Dialogue/Role Play Conflict and Resolution.

Unit-II-

LEADERSHIP & PARTICIPATION: Leadership skills, Attitudes, Sensitivity training. Learning/'Take-aways' from scenarios/situations; Communication Skills; Seven Cs of Communication; Barriers to Effective Communication; Crisis-handling; Negotiation-Conflict resolution exercises.

Unit –III-

CREATIVE COMPOSITION&TECHNICAL WRITING: Exercises in creative writing: USP and image building; Setting Goals; Charting Objectives; Hypothesis; Thesis; Writing Abstracts; Reports; Resume and Covering Letter.

Unit-IV-

CORPORATE INTERACTION & COMMUNICATION: Review of social, political and corporate scene; Group Discussions with prior briefs on CSR and IPR and role of important international bodies like WTO and IMF; Presentations; Technical/Business vocabulary; Body Language; Presentation Skills; Mock-interviews.

Course Outcome:

1. Students will be able to connect science and technology with society.
2. Students will learn to prepare for Group Discussions and thus, be able to perform well in discussions, debates and interviews; students will understand forms of corporate communication and learn about formats and layouts of report writing and other forms of business communication.
3. Students will learn about conflict negotiation and crisis handling.
4. Students will have emulated good communication practices for better leadership and team-building.

References:

Stephen Robbins and Seema Sanghi. Organizational Behaviour. Pearson. Latest edition.

Kotler, Philip and Kevin Lane Keller. Marketing Management. 13 th edition.2008 Eastern Economy Edition

Wehmeier, Sally .*Oxford Advanced Learner's Dictionary*. Oxford UP.2005

Ghosh, BN. Managing Soft Skills for Personality Development.Tata McGraw-Hill 2012

Rizvi, M Ashraf. *Effective Technical Communication*. Tata Mc Graw-Hill.2005

Bretag, Crossman and Bordia.Communication Skills. Tata Mc Graw-Hill.2009

Sites: Youtube and Wikipedia in general.

OPHL-306A PHYSICS AND OUR WORLD

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 OBJECTIVE

The course aims to provide the students fundamentals of Physics and of our world

UNIT-I:

Space and Time:A discussion on length scales and dimensions, Galaxies, The solar system and the planet Earth, Rotation and Revolution of the Earth, Seasons, Calendars in History and the recording of time, Laws of motions- A Discussions of principles, theories and models, Gravitation, Planetary motion and Keplar's Laws, the laws of motion in the eyes of Galileo and Newton.

UNIT-II:

Theory of Relativity: The relationship between Space and time: A basic account of theory of Relativity, Does nature differentiate between left and right?- The notion of Parity, Is there an "Arrow" of time?. Entropy and Laws of Thermodynamics, The Size of the Universe- Is the Universe expanding?

UNIT-III:

Matter and Energy: Discrete and continuous matter- a brief historical survey, Atoms and molecule: Structure of atoms, the nucleus, Elementary particles, Unification of forces. Equivalence of matter and energy, Nuclear energy and thermodynamics power. The Periodic table of elements, chemical bonds and molecules, Large molecules and living matter.

UNIT-IV

Electromagnetic Energy: Waves and oscillations, Electromagnetic radiation and spectrum, Propagation of waves, Energy in the atmosphere- Wind and solar energy, Weather predictability

and chaos, Indeterminacy, The quantum world—an introduction, Debates on the conceptualization of physical realities- is nature unreasonably mathematical?

COURSE OUTCOME

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

- Understand the relation between space and time.
- Learn the about the elementary particles and equivalence of energy and matter
- Learn about matter and energy
- Comprehend the basics of Electromagnetic energy

REFERENCE BOOKS:

1. The Evolution of Physics-Einstein and L. Infeld, Toughstone 1967
2. The Ascent of Man-J. Bronowski, laffle and Brown Company, 1976
3. Commos- Carl sagan, McDonald and Company, 2003.

OPHL-305A INTRODUCTION TO ASTROPHYSICS AND COSMOLOGY

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 OBJECTIVE:

To show how the properties of astronomical objects and the Universe relate to simple physical laws and processes

COURSE OUTCOMES

On completion successful students will be able to:

1. Have an understanding of the role and physics of detectors and telescopes including geometric optics and understand how distances are measured.
2. Know how basic laws of physics determine the properties and evolution of stars.
3. Know Kepler's Laws and how they relate to extrasolar planet detection.
4. Understand how the dynamics of galaxies indicate the presence of dark matter and demonstrate an understanding of the evolution of our Universe.

SYLLABUS

UNIT I:

The Universe and its physics: A tour of the Universe, its scale and contents; Gravity; Pressure; RadiationObservational astronomy: the electromagnetic spectrum; geometrical optics; resolving power, and the diffraction limit; telescopes and detectors; gravitational waves; Distances: parallax measurements, standard candles

UNIT II:

Physics of the Sun and Stars: blackbody radiation, the Planck, Stefan-Boltzmann and Wien laws, effective temperature, interstellar reddening; hydrogen spectral lines and Doppler effect; Hertzprung-Russell diagram; Freefall and Kelvin-Helmholtz time; nuclear fusion; basic stellar structure (hydrostatic equilibrium, equation of state); white dwarfs, neutron stars and black holes

UNIT III:

Planetary systems: Kepler's laws; Detection methods of extrasolar planets; search for life elsewhere.

UNIT IV:

Star formation: the interstellar medium; stellar populations; the interstellar medium; galaxy rotation curves, mass and dark matter; Galaxy collisions; central engines; Cosmology:Olber's paradox, Hubble's Law; the age of the Universe; Evolution of the Universe: Madau diagram; Evidence for the Big Bang (blackbody radiation, nucleosynthesis); dark energy and the accelerating Universe.

References:

1. Carroll, B.W. & Ostlie, D.A., *An Introduction to Modern Astrophysics* (Pearson

OES-301A WASTE MANAGEMENT IN OUR DAILY LIFE

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

The course aims at to provide knowledge about characteristics and types of solid waste generated in our daily life. The students will be able to learn various methods for waste processing, prevention, treatment and final disposal and may apply in their daily life.

COURSE OUTCOMES:

After completing this course, the students will be able to:
- Understand the characteristics and types of solid waste.
- Know about various methods for waste processing and prevention.
- Apply the knowledge for waste treatment.
- Get knowledge of final disposal of wastes in daily life.

UNIT 1: WASTE

What is waste? Sources of waste generation; Composition and classification of waste; Sorting and segregation of waste at source of generation (kitchen, garden, residential colonies and commercial areas); waste collection – sample collection bins; storage and transport.

UNIT 2: WASTE PROCESSING AND PREVENTION

Waste prevention and recycling at home, small communities; reduce, recycle and reuse; Waste processing – size and volume reduction.

UNIT 3: WASTE TREATMENT

Safe disposal of waste; open dumping, problems of open dumping and burning; landfills; diseases associated with waste handling; Best practices for solid waste disposal

UNIT 4: DISPOSAL OF WASTE

Composting – vermicomposting, kitchen garden; anaerobic digestion – biogas, manure; waste to energy – pyrolysis, refuse derived fuels.

REFERENCES:

1. Ramachandra T.V., (2009), *Management of municipal solid waste*, published by TERI Press, New Delhi.

2. Williams, P. T. Williams A. (2005), *Waste treatment and disposal*, 2nd Edition Wiley publications, UK.

3. Dhamija, U., (2009). *Sustainable solid waste management: issues, policies, and structures*. Academic Foundation, New Delhi.

OES- 302A ENVIRONMENTAL CONSERVATION

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:

The course provides students a comprehensive review of our natural resources including land, water, energy, biodiversity, etc. The students will be able to understand the importance of natural resource management and market based mechanisms for environment protection.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Understand about various natural resources.
- Know about various methods for soil and water conservation.
- Apply the knowledge for biodiversity conservation.
- Get knowledge of energy conservation.

UNIT 1: INTRODUCTION

Man and environment, Importance of environmental conservation, natural resources, waste as a resource.

UNIT 2: SOIL AND WATER CONSERVATION

Land degradation, soil erosion, conservation measures – afforestation, mulching, Soil fertility restoration - organic manure application, need for sustainable water management, judicious water consumption at home, measures for effective irrigation – sprinkler, drip, watershed management, rain water harvesting, indigenous micro-irrigation devices. Evaluation of water footprints – A case study.

UNIT 3: BIODIVERSITY CONSERVATION

Significance of biodiversity conservation, threats to biodiversity – pollution, population, habitat destruction, overexploitation, man- wildlife conflicts, strategies for biodiversity conservation - garden – herbal, ornamental, kitchen, organic farming and biodiversity conservation, conservation farming, national parks, sanctuaries, zoo, botanical gardens, Forest and wildlife conservation.

UNIT 4: ENERGY CONSERVATION

Ways to conserve energy at home, offices, buildings, energy efficiency – electrical appliances, CFL, LEDs, OLEDs, clean fuels for vehicles. Evaluation of carbon footprints – A case study.

REFERENCES:

1. Ahluwalia, V.K. Environmental Studies : Basic concepts, TERI, 2013.
2. Beheim, Einar (Ed.) Integrated watershed management : perspectives and problems, Springer, 2010.
3. Bhatt, S. Environment protection and sustainable development, APH Publishing Corporation,2004.
4. Burchett, Stephen. Introduction to wildlife conservation in farming, Wiley- Blackwell, 2010.
5. Das, S.K. Watershed development and livelihoods: People's action in India,Routledge India,2007.
6. Fa, John E. Zoo Conservation Biology (Ecology, Biodiversity and Conservation), Durrell Wildlife Conservation Trust, 2011.
7. Fatik B. Mandal. And Nepal C. Nandi. Biodiversity: concepts, conservation and biofuture, Asian Books, 2013
8. Heathcote, Isobel W. Integrated watershed management : principles and practice (2nd Ed), John Wiley & Sons, 2009
9. Prasad, Govid Conservation of natural Resources, Discovery Publishing, New Delhi,2013.
10.Srivastav, Sweta. Basics of Environmental Science, Anmol Publications Pvt Ltd, 2008.

COURSES OFFERED BY MANAGEMENT DEPARTMENT
(OPEN ELECTIVE COURSES-OEC-III)

OEC-ME-444 HUMAN RESOURCE MANAGEMENT

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:

The primary concern of this course is to sensitize students to the various facts of managing people and to create an understanding of the various policies and practices of human resource management.

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

CO1- Understand the basics of HRM with roles and responsibilities of a manager.

CO2- Meet HR challenges in present scenario

CO3- Employ, maintain and promote a motivated force in an organization.

CO4 - Be aware about contemporary issues of human resource management.

UNIT 1:

Human Resource Management: concept and scope; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals; Human Resource Planning & Forecasting: significance and process.

UNIT 2:

HR Sourcing: Recruitment, Selection and Induction. Job Analysis: job Description and job Specification; Job Design: concept and methods; Job Evaluation-concept &methods; Performance appraisal and counselling.

UNIT 3:

Training: training process and methods; Career planning and Development; Succession planning; Employee Compensation: basic concepts & determinants;

UNIT 4:

Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM. HR Audit &Accounting, ethics & corporate social responsibility.

Text Books/ Reference Books:

1. K. Aswathapa Human resource Management: Text and cases, 6th edition, Tata McGraw Hill, New Delhi,2012

2. Uday Kumar Haldar &Juthika Sarkar(2012) Human resource Management New Delhi, Oxford University Press.

3. De Cenvo, Da & Robbins S.P.(2010) Fundamentals of Human Resource Management, 9th edition, New York, John Wiley & Sons.

4. Gary Dessler (2008) Human Resource Management, 11th edition New Delhi: Pearson Prentice Hall. 5. Tanuja Agarwala, Strategic Human resource Management, Oxford University Press 2007.

OEC-ME-446 FINANCE AND ACCOUNTING

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:

The purpose of the course is to understand nature of accounting and its interaction with other accounting and their comparison. It also focuses what kind of information the managers need, from where these can be obtained and how this information can be used to carry out important managerial decision.

MODULE-1:

Meaning nature and scope of different types of accounting and their comparison. Accounting principles and Indian accounting standards, IFRS, Preparation of final accounts of company with basic adjustments. Reading and understanding of Annualreport.

MODULE-2:

Analysis and interpretation of financial statements – meaning, importance and techniques, ratio analysis; fund flow analysis; cash flow analysis (AS-3)

MODULE-3:

Classification of costs, preparation of cost sheet, inventory valuation, overview of standard costing and variance analysis; material variance and labour variance.

MODULE-4:

Budgetary control- meaning, need, objectives, essentials of budgeting, different types of budgets cash budget, flexible budget zero base budget; marginal costing, BEP analysis, decision making for optimum sales mix, exploring new markets, make/Buy decisions, expand/ contract, accepting and rejecting decisions

Course Outcomes:

1. This course will impart knowledge to the students regarding preparation of financial statements theiranalysis.

2. The students will be able to understand applications of cost accounting and cost control techniques like standard costingetc.
3. The course will help them to take better managerialdecisions.
4. Students will be able to know about budget controltechniques.

REFERENCES:

1. Singhal, A.K. and Ghosh Roy, H.J., Accounting for Managers, JBC Publishersand Distributors, NewDelhi
2. Pandey, I.M., Management Accounting, Vikas Publishing House, NewDelhi
3. Horngren, Sundem and Stratton, Introduction to Management Accounting, Pearson Education, NewDelhi.
4. Jain, S.P and Narang, K.L., Advanced Cost Accounting, Kalyani Publishers, Ludhiana.
5. Khan, M.Y. and Jain, P.K., Management Accounting, TMH, NewDelhi

OEC-ME-450 ENTREPRENEUR DEVELOPMENT

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:

The aim of this course is to provide know-how for being able to start a new entreprise by identifying the entrepreneurial opportunities, support and resource requirements.

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

CO 1-Acquire knowledge about entrepreneur and entrepreneurship.

CO 2- Understand the various activities involved in establishment of a business.

CO 3-Identify the environmental and operational issues of a business enterprise.

CO 4-Understand the government role and appraisal methods and growth strategies.

Course Contents:

UNIT 1:

Concept of Entrepreneur, Characteristics, qualities and pre-requisites of entrepreneur, entrepreneurship and intrapreneur, Entrepreneur vs. Manager; Economic, social and psychological need for entrepreneurship;

UNIT 2:

Environmental Factors affecting success of a new business, Formulation of business plan, Contents and significance of business plan

UNIT 3:

Feasibility Study -Preparation of Feasibility Reports: Economic, Technical, Financial and Managerial Feasibility of Project, Methods and procedures to start and expand one's own business

UNIT 4:

Role of Government and Promotional agencies in entrepreneurship development, Entrepreneurship Development Programmes

Reference Books:

- Khanka S.S., “Entrepreneurship Development”. S.Chand.
- Desai, A N. "Entrepreneur & Environment". 1990. Ashish, New Delhi.
- Drucker, Peter. "Innovation and Entrepreneurship". 1985. Heinemann, London.
- Jain Rajiv. "Planning a Small Scale Industry: A Guide to Entrepreneurs". 1984. S.S. Books, Delhi.
- Kumar, S A. "Entrepreneurship in Small Industry". 1990, Discovery, New Delhi.
- McClelland, D C and Winter, W G. "Motivating Economic Achievement". 1969. Free Press, New York.
- Pareek, Udai and VenkateswaraRao, T. "Developing Entrepreneurship -A Handbook on Learning Systems". 1978, Learning Systems, Delhi.

OEC-ME-452 ECONOMICS FOR ENGINEERS

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):

1. The course will impart knowledge of economic forces influencing an organisation
2. This course will enable students to take decisions on the basis of interaction of market
3. The course will help students to be efficient engineers by utilizing limited resources to satisfy unlimited wants
4. The course will enable students to take decisions regarding price determination on the basis of market structure.

Course Contents:

Unit 1

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

Unit 2

Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)

Unit 3

Meaning of Demand. Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)

Unit 4

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

Unit 5

Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (main features). Supply and law of supply, Role of demand and supply in price determination.

Unit 6

Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy,

LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks

Recommended/ Reference Books:

1. Jain T.R., "Economics for Engineers", VK Publication
2. Chopra P. N., "Principle of Economics", Kalyani Publishers
3. Dewett K. K., "Modern economic theory", S. Chand
4. H. L. Ahuja., "Modern economic theory", S. Chand
5. Dutt Rudar & Sundhram K. P. M., "Indian Economy"
6. Mishra S. K., "Modern Micro Economics", Pragati Publications
7. Pandey I.M., "Financial Management"; Vikas Publishing House
8. Gupta Shashi K., "Management Accounting", Kalyani Publication

VALUE ADDED COURSES

CODE: HSMC (H-102)

UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

NO OF CREDITS: 0 **L T P T**

2 1 0 3

This value-added course is for UG/PG students. It may be taught through digital aided learning/class room teaching. Its duration is 35 hours. Minimum 75% attendance is compulsory for students and its evaluation will be done by concerned Dept. through Viva-Voce examination/internal examination.

Pre-requisites: None. Universal Human Values 1 (desirable)

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Human Values Course

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as "H-102 Universal Human Values 2: Understanding Harmony" is designed which may be covered in their III or IV semester. During the Induction Program, students would get and initial exposure to human values through Universal Human Values –I. This exposure is to be augmented by this compulsory full semester foundation course.

Universal Human Values 2: Understanding Harmony

MODULE-1: COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; _Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE-2: UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

1. Understanding human being as a co-existence of the sentient _I' and the material _Body'
2. Understanding the needs of Self (_I') and _Body' - happiness and physical facility
3. Understanding the Body as an instrument of _I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of _I' and harmony in _I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE-3: UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETYHARMONY IN HUMAN – HUMAN RELATIONSHIP

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students‘ lives

MODULE-4: UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and selfregulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film ―Home‖ can be used), pollution, depletion of resources and role of technology etc.

MODULE-:5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems

6. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Course Outcomes: By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. This is only an introductory foundational input. It would be desirable to follow it up by

a) faculty-student or mentor-mentee programs throughout their time with the institution

b) Higher level courses on human values in every aspect of living. e.g. as a professional

READINGS:

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)

13. Gandhi - Romain Rolland (English)

ASSESSMENT

This is a compulsory non-credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:
Assessment by faculty mentor: 10 marks
Self –assessment: 10 marks
Assessment by peers: 10 marks
Socially relevant project/Group Activities/Assignments: 20 marks
Semester End Examination: 50 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

VAC01: HUMAN VALUES AND PROFESSIONAL ETHICS

NO OF CREDITS: 0 **L T P T**

2 1 0 3

This course may be taught through digital aided learning / classroom teaching. Its duration is 31-35 hours. Minimum 75% attendance is compulsory for students and its evaluation will be done by concerned Dept. through Viva-Voce examination. These are recommended in I year.

PROFESSIONAL ETHICS OBJECTIVES:

To enable the students to create an awareness on Ethics and Human Values, to instil Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I: HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II: ETHICS

Senses of Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy –Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion.

UNIT III: PROFESSIONALS AS SOCIAL EXPERIMENTATION

Social Experimentation – Professionals as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV: SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality –Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) Gender inequality , causes and consequences. Discrimination, Social understandings, Women and Men in the Organization, Consequences of sexual harassment.

UNIT V: GLOBAL ISSUES

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development

– Professionals as Managers – Consulting Engineers – Professionals as Expert Witnesses and Advisors Moral Leadership – Code of Conduct – Corporate Social Responsibility.

COURSE OUTCOMES: Upon completion of the course, the student should be able to:

CO1- Apply ethics in society

CO2- Discuss the ethical issues related to engineering.

CO3- Realize the responsibilities as a good citizen.

CO4- Realize the rights in the society.

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009

3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.

Web sources:

1. www.onlineethics.org
2. www.globalethics.org
3. www.ethics.org

ANNEXURE-A

Courses in Syllabus having direct bearing on Employability/ Entrepreneurship/ Skill Development

Courses in Syllabus having direct bearing on Employability/ Entrepreneurship/ Skill development

S.No.	Course Code	Course Name	Employability	Entrepreneurship	Skill Development
1.	PCC-ME-301/21	Thermodynamics	√		√
2.	PCC-ME-302/21	Strength of Materials-I	√		√
3.	PCC-ME-303/21	Fluid Mechanics and Machines	√	√	√
4.	PCC-ME-304/21	Strength of Materials Lab	√	√	√
5.	PCC-ME-305/21	Fluid Mechanics and Machines Lab	√	√	√
6.	PCC-ME-401/21	Applied Thermodynamics	√		√
7.	PCC-ME-402/21	Materials Engineering	√	√	√
8.	PCC-ME-403/21	Kinematics of Machines	√	√	√
9.	PCC-ME-404/21	Strength of Materials-II	√	√	√
10.	PCC-ME-405/21	Manufacturing Processes	√	√	√
11.	PCC-ME-406/21	Thermal Lab –I	√	√	√
12.	PCC-ME-407/21	Materials Engineering Lab	√	√	√
13.	PCC-ME-408/21	Kinematics of Machines Lab	√	√	√
14.	PCC-ME-501/21	Heat and Mass Transfer	√		√
15.	PCC-ME-502/21	Dynamics of Machines	√	√	√
16.	PCC-ME-503/21	Design of Machine Elements-I	√	√	√
17.	PCC-ME-504/21	Refrigeration and Air-conditioning	√	√	√
18.	PCC-ME-505/21	Industrial Engineering	√	√	√
19.	PCC-ME-506/21	Thermal Lab- II	√	√	√
20.	PCC-ME-507/21	Dynamics of Machines Lab	√	√	√
21.	PCC-ME-601/21	CAD/ CAM	√	√	√
22.	PCC-ME-602/21	Manufacturing Technology	√	√	√
23.	PCC-ME-603/21	Design of Machine Elements – II	√	√	√
24.	PCC-ME-604/21	CAD/ CAM Lab	√	√	√
25.	PCC-ME-701/21	Automation in Manufacturing	√	√	√
26.	PCC-ME-702/21	Operations Research	√	√	√
27.	BSC-103A	Mathematics-I		√	√
28.	BSC-102	Chemistry		√	√
29.	BSC-105	Chemistry Lab		√	√
30.	BSC-101F	Physics		√	√
31.	BSC-106A	Mathematics- II		√	√
32.	BSC-104A	Physics Lab		√	√
33.	BSC-201	Mathematics-III		√	√
34.	BSC-01	Biology			√
35.	ESC-101A	Basic Electrical Technology	√	√	√
36.	ESC-107A	Basic Electrical Technology	√	√	√

		Laboratory			
37.	ESC-104A/21	Workshop- I	√	√	√
38.	ESC-103	Programming for Problem Solving	√	√	√
39.	ESC-105	Programming for Problem Solving Lab	√	√	√
40.	ESC-102A/21	Engineering Graphics and Drawing	√	√	√
41.	ESC-106A/21	Workshop- II	√	√	√
42.	ESC-201	Basics of Electronics Engineering	√	√	√
43.	ESC-203A/21	Engineering Mechanics	√	√	√
44.	HSMC-101	English	√	√	√
45.	HSMC-102	English Lab	√	√	√
46.	SEC-WS-301/21	Workshop III	√	√	√
47.	SEC-WS-401/21	Workshop IV	√	√	√
48.	SEC-WS-501/21	Workshop V	√	√	√
49.	SEC-WS-601/21	Workshop VI	√	√	√
50.	SEC-WS-701/21	Workshop VII	√	√	√
51.	SEC-401/21	Project I	√	√	√
52.	SEC-601/21	Project II	√	√	√
53.	SEC-701/21	Project III	√	√	√
54.	SEC-801/21	Industrial Training	√	√	√
55.	MCEVS-01	Environment and Ecology		√	√
56.	MCEVS-02	National Resources and Biodiversity Conservation		√	√
57.	MCEVS-03	Environment Pollution, Waste Management and Sanitation		√	√
58.	MC-02	Essence of Indian Traditional Knowledge		√	√
59.	MC-04G	Message of Bhagavad Gita	√	√	√
60.	HSMC (H-102)	Universal Human Values 2: Understanding Harmony	√	√	√
61.	VAC01	Human Values and Professional Ethics	√	√	√
62.	PEC-ME-601/21	Visionary Learning in Manufacturing	√	√	√
63.	PEC-ME-602/21	Product Design and Development	√	√	√
64.	PEC-ME-603/21	Internal Combustion Engines	√	√	√
65.	PEC-ME-604/21	Gas Dynamics and Jet Propulsion	√	√	√
66.	PEC-ME-605/21	Welding Technology	√	√	√

67.	PEC-ME-606/21	Mechatronics Systems	√	√	√
68.	PEC-ME-621/21	Flexible Manufacturing Systems	√	√	√
69.	PEC-ME-622/21	Reliability, Availability and Maintainability	√	√	√
70.	PEC-ME-623/21	Principles of Management	√	√	√
71.	PEC-ME-624/21	Aircraft Technology	√	√	√
72.	PEC-ME-625/21	Numeric Control of Machine Tools, Robotics and Rapid Prototyping	√	√	√
73.	PEC-ME-626/21	Industrial Tribology and Lubrication	√	√	√
74.	PEC-ME-627/21	Electric Vehicle and Transmission System	√	√	√
75.	PEC-ME-701/21	Maintenance Engineering and Management	√	√	√
76.	PEC-ME-702/21	Total Quality Management	√	√	√
77.	PEC-ME-703/21	Non-Conventional Energy Resources Utilization	√	√	√
78.	PEC-ME-704/21	Air Conditioning Equipments	√	√	√
79.	PEC-ME-705/21	Tool Design	√	√	√
80.	PEC-ME-706/21	Acoustics and Vibrations	√	√	√
81.	PEC-ME-721/21	New Venture Creation	√	√	√
82.	PEC-ME-722/21	Project Management	√	√	√
83.	PEC-ME-723/21	Automobile Engineering	√	√	√
84.	PEC-ME-724/21	Design of Thermal Systems	√	√	√
85.	PEC-ME-725/21	Metallurgy	√	√	√
86.	PEC-ME-726/21	Composite Materials	√	√	√
87.	PEC-ME-727/21	Modeling, Simulation and Optimization	√	√	√
88.	PEC-ME-741/21	Marketing Management	√	√	√
89.	PEC-ME-742/21	Process Planning and Cost Estimation	√	√	√
90.	PEC-ME-743/21	Quality Management Systems	√	√	√
91.	PEC-ME-744/21	Power Plant Engineering	√	√	√
92.	PEC-ME-745/21	Energy Conservation and Management	√	√	√
93.	PEC-ME-746/21	Micro and Nano Manufacturing	√	√	√
94.	PEC-ME-747/21	Finite Element Analysis	√	√	√
95.	OEC-ME-501	Intelligent Systems	√	√	√
96.	OEC-ME-502	Cyber laws and Security	√	√	√
97.	OEC-ME-503	Soft Computing	√	√	√
98.	OEC-ME-504	Web Technology and Information Retrieval	√	√	√
99.	OEC-ME-505	Intellectual Property and	√	√	√

		Rights			
100.	OEC-ME-506	Basic Environmental Engineering	√	√	√
101.	OEC-ME-507	Traffic Engineering and Management	√	√	√
102.	OEC-ME-508	Contracts Management	√	√	√
103.	OEC-ME-509	Solid and Hazardous Waste Management	√	√	√
104.	OEC-ME-510	Air and Noise Pollution and Control	√	√	√
105.	ELPE411	Electrical Energy Conservation and Auditing	√	√	√
106.	ELPE412	Industrial Electrical System	√	√	√
107.	ELPC 502	Control System	√	√	√
108.	ELPE614	Wind and Solar Energy System	√	√	√
109.	ELPE612	Electrical and Hybrid Vehicles	√	√	√
110.	OEC-ME-606	Microprocessor and Interfacing		√	√
111.	OEC-ME-608	Digital Signal Processing		√	√
112.	OEC-ME-610	Instrumentation and Control		√	√
113.	OEC-ME-612	Data Communication and Networking		√	√
114.	OEC-ME-442	Soft Skills for Engineers	√	√	√
115.	OPHL-306A	Physics and Our World	√		
116.	OPHL-305A	Introduction to Astrophysics and Cosmology	√		
117.	OES-301A	Waste Management in our Daily Life	√	√	√
118.	OES-302A	Environmental Conservation	√	√	√
119.	OEC-ME-444	Human Resource Management	√	√	√
120.	OEC-ME-446	Finance and Accounting	√	√	√
121.	OEC-ME-450	Entrepreneur Development	√	√	√
122.	OEC-ME-452	Economics for Engineers	√	√	√

ANNEXURE-B

FOR

MOOC COURSES

Implementation of Credit Transfer/Mobility Policy of online courses

Reference: Gazette of India (Extraordinary) Part-III, Section-4 No. 295, UGC (**Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016,** dated 19/07/2016.

With reference to 12th Academic Council Meeting dated 03/05/2017 (Agenda Item No. AC/11/12), wherein MOOCs were adopted in the CBCS scheme, In continuation to that, following modalities are proposed to introduce the credit transfer policy in academic curriculum for the Massive Open Online Courses (MOOC's) offered through SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) Portal.

A. General Guidelines

1. The SWAYAM shall notify in June and November every year, the list of the online learning Courses going to be offered in the forthcoming Semester on its website https://swayam.gov.in.

2. All the UTDs/Affiliated Colleges shall, within 4 weeks from the date of notification by SWAYAM, consider through their Chairperson/Principal the online learning courses being offered through the SWAYAM platform; and keeping in view their academic requirements, decide upon the courses which it shall permit for credit transfer and keeping in view the following points:

    a) There is non-availability of suitable teaching staff for running a course in the Department.

    b) The facilities for offering the elective papers (courses), sought for by the students are not on offer/scheme in the Institution, but are available on the SWAYAM platform.

    c) The courses offered on SWAYAM would supplement the teaching-learning process in the Institution.

    d) Online courses through SWAYAM should not be more than 20% of total courses offered in a particular semester of a programme.

3. The courses offered in a particular semester will be compiled by Digital India Cell as decided and forwarded by concerned UTDs and affiliated colleges in the prescribed format to digitalindia.ymca@gmail.com and compiled set will be put up in Academic Council for approval.

4. Student can opt for 12-16 weeks course equivalent to 3-6 credits under mentorship of faculty (MHRD MOOC's guidelines 11.1(J) issued by the MHRD vide its orders dated 11/03/2016).

5. Every student being offered a particular paper (course) would be required to register for the MOOCs for that course/paper on SWAYAM through University's/Affiliated College's SWAYAM-NPTEL Local Chapter.

6. The UTD/College may designate a faculty member as course coordinator/mentor to guide the students (at least 20 students) throughout the course with 2 hours per week contribution and with mentor addition on the Local Chapter. The mentor Chairperson/Principal will ensure the provision of facilities for smooth running of the course viz. Internet facility and proper venue in the department/college.

7. Digital India Cell of the University will be the Nodal point for keeping track of MOOCs enrolments in the University and the concerned chairpersons/principals are expected to aware their students/faculty about the online courses.

8. Importance of online learning and credit transfer policy must be shared with the students at entry level by the concerned department/college. Same may be incorporated during induction program for newly admitted students.

9. The departmental/college MOOC coordinators appointed by chairpersons of concerned departments/Principals of affiliated colleges will be responsible for identification of relevant MOOCs in the UTDs/Colleges and smooth conduction during the course.

B. Credit Transfer/Mobility of MOOCs

1. The parent Institution (offering the Course) shall give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform in the credit plan of the program.

2. Following pattern will be followed for distribution of credits and will be applicable to all students from Jan 2018 onwards:

Program	Duration	Minimum Credits to be earned*
B.Tech	Semester I to VIII	3
M.Tech/MBA/M.Sc./MA	Semester I to IV	3
BBA/BCA/B.Sc./BA	Semester I to VI	3

***All students of UTDs/Affiliated colleges of all courses have to mandatorily earn minimum prescribed credits. Note: From session 2019-20 onwards, for B.Tech program, a student has to earn at least 12 credits during the duration of the Degree subject to the passing of at least one MOOC course (carrying minimum 3 credits per year).**

3. A student will be eligible to get Under-Graduate/Post-Graduate degree (B.Tech/M.Tech) with Honours if he/she completes additional credits through MOOC's. (AICTE Model Curriculum, Chapter1(B)). Following pattern will be followed for earning additional credits for the award of Honours degree:

Program	**Duration**	**Credits to be earned***	**Minimum CGPA**
B.Tech	Semester I to VIII	12	8.0
M.Tech	Semester I to IV	6	8.0

*Inclusive of *Minimum credits to be earned* mentioned in clause B(2) above.

4. The earned credits shall be accepted and transferred to the total credits of the concerned students by the University for Completion of his/her degree. Credits earned through MOOCs will be incorporated in the mark sheet issued to the student by Controller of Examination.

5. Credits for MOOC's will be verified by the concerned department/college and will be forwarded to Controller of Examination for further processing.

6. The courses where model curriculum of AICTE is not applicable, pattern laid down as in B(2) will be followed.

NOTE:

1. These guidelines will be applicable to all Affiliating institutions under University along with all UTDs. Affiliating colleges will establish their own Local Chapter on SWAYAM and follow the same process.

2. For further clarifications, Notifications "Credit Framework for Online Learning Courses through SWAYAM" (UGC Regulations dated 19/07/2016) and "MHRD MOOC's guidelines" (MHRD guidelines dated 11/03/2016) may be referred.

Approved in 17th Academic Council Dated 11.06.2019