GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University)
VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^+ Grade

REGULATIONS AND SYLLABUS

OF

M.Tech. Manufacturing Technology and Automation

(w.e.f. 2020-21 admitted batch)

M. Tech. in MANUFACTURING TECHNOLOGY & AUTOMATION

REGULATIONS

(w.e.f. 2020-21 admitted batch)

1. ADMISSION

Admission into M.Tech in Machine Design program of GITAM (Deemed to be University) is governed by GITAM admission regulations.

2. ELIGIBILITY CRITERIA

A pass in B.E./B.Tech./AMIE in Mechanical Engineering or its equivalent.

Admissions into M.Tech will be based on the following:

(i) Score obtained in GAT (PG), if conducted.
(ii) Performance in Qualifying Examination/Interview.
(iii) Candidates with valid GATE score shall be exempted from appearing for GAT(PG).

The actual weightage to be given to the above items will be decided by the authorities at the time of admissions.

3. CHOICE BASED CREDIT SYSTEM

Choice Based Credit System (CBCS) was introduced with effect from 2015-16 admitted batch and revised with effect from academic year 2019-20 in order to promote:

- Student centered Learning
- Activity based learning
- Students to learn courses of their choice
- Cafeteria approach

Learning objectives and outcomes are outlined for each course to enable a student to know what he/she will be able to do at the end of the program.

4. STRUCTURE OF THE PROGRAM

The Program Consists of

i) Core Courses (compulsory) which give exposure to a student in core subjects related area.

ii) Program Electives.

iii) Open Electives

iv) Mandatory and Audit Courses

Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

In general, credits are assigned to the courses based on the following contact hours per week per semester.

- One credit for each Lecture / Tutorial hour per week.
- One credit for two hours of Practicals per week.

The curriculum of the four semesters M.Tech. program is designed to have a total of 68 credits for the award of M.Tech. degree.

5. MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION

Every student has to register for the courses in each semester at the time specified in the academic calendar.

7. ATTENDANCE REQUIREMENTS

A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the semester-end examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 65% and 74% on genuine grounds and on payment of prescribed fee.

8. EVALUATION

The assessment of the student's performance in a theory course shall be based on two components: Continuous Evaluation (40 marks) and semester-end examination (60 marks).

A student has to secure a minimum of 40% in any theory course in the two components (ref. 8.1) put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.

Practical/ Project Work/ Viva voce/ Seminar etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

Audit courses are assessed through continuous evaluation for satisfactory or not satisfactory only. No credits will be assigned.

Table 1: Assessment Procedure

S.No.	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Evaluation
1	Theory Courses	40	Continuous Evaluation	i) Thirty (30) marks for mid Semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration. ii) Ten (10) marks for Quizzes, Assignments and Presentations. Sixty (60) marks for Semester-end examinations
		60	Semester-end Examination	
	Total	100		

2	Practical Courses	100	Continuous Evaluation	i) Fifty (50) marks for regularity and performance, records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the semester. ii) Ten (10) marks for case studies. iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the semester) conducted by the concerned lab teacher.
3	Technical Seminar (II Semester)	100	Continuous Evaluation	Through five periodic seminars of 20 marks each
4	Project Work (III Semester)	100	Continuous Evaluation	i) Forty (40) marks for periodic assessment on originality, innovation, sincerity and progress of the work, assessed by the project supervisor. ii) Thirty (30) marks for mid-term evaluation for defending the project, before a panel of examiners. iii) Thirty (30) marks for final report presentation and viva-voce, by a panel of examiners*.
5	Project Work (IV Semester)	50	Continuous Evaluation	i) Twenty (20) marks for periodic assessment on originality innovation, sincerity and progress of the work, assessed by the project supervisor. ii) Fifteen (15) marks for mid-term evaluation for defending the project, before a panel of examiners*. iii) Fifteen (15) marks for interim report presentation and viva-voce.
		50	Semester-end Examination	Fifty (50) marks for final project report and viva-voce examination assessed by external examiners.
	Total	100		

6	Audit Courses	100	Continuous Evaluation	Audit courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures a minimum of 40 out of 100 marks during continuous evaluation, he / she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree

**Panel of Examiners shall be appointed by the concerned Head of the Department*

9. PROVISION FOR ANSWER BOOK VERIFICATION AND CHALLENGE EVALUATION

If a student is not satisfied with his/her grade, the student can apply for answer book verification on payment of prescribed fee for each course within one week after announcement of results.

After verification, if a student is not satisfied with revaluation marks/grade, he/she can apply for challenge valuation within one week after announcement of answer book verification result or two weeks after the announcement of results, which will be valued by two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned, if the student is successful in the appeal by securing a better grade.

10. SUPPLEMENTARY AND SPECIAL EXAMINATIONS

The odd semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

The even semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

A student who has secured 'F' Grade in Project work shall have to improve his/her work and reappear for viva-voce after satisfactory completion of work approved by panel of examiners.

A student who has completed period of study and has "F" grade in final semester courses is eligible to appear for special examination.

11. MASSIVE OPEN ONLINE COURSES (MOOCs)

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (**MOOCs**) during the period of study. Students without any backlog courses up to first semester are permitted to register for MOOCs in second semester up to a maximum of 6 credits from program elective / open elective/audit courses. However the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs. The grade equivalency will be decided by the respective Board of Studies (BoS).

12. GRADING SYSTEM

Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades and Grade Points

Sl. No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab (Absent)	0	-

A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course, subject to securing a GPA of 5.0 for a Pass in the semester.

13. GRADE POINT AVERAGE

A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{\Sigma [C \times G]}{\Sigma C}$$

where, C = number of credits for the course,

G = grade points obtained by the student in the course.

The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester.

CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for Award of Class

Class	**CGPA Required**
First Class with Distinction	$\geq$ 8.0*
First Class	$\geq$ 6.5
Second Class	$\geq$ 5.5
Pass Class	$>$ 5.0

* In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses of every semester in the first attempt.

14. ELIGIBILITY FOR AWARD OF THE M. Tech. DEGREE

Duration of the program: A student is ordinarily expected to complete the M. Tech. Program in four semesters of two years. However a student may complete the program in not more than four years including study period. However the above regulation may be relaxed by the Vice-Chancellor in individual cases for cogent and sufficient reasons.

A student shall be eligible for award of the M.Tech. Degree if he / she fulfills all the following conditions.

a) Registered and successfully completed all the courses and project works.

b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated period.

c) Has no dues to the Institute, Hostels, Libraries, NCC / NSS etc, and

d) No disciplinary action is pending against him / her.

15. DISCRETIONARY POWER

Notwithstanding anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

Department of Mechanical Engineering, GIT
GITAM (Deemed to be University)

Vision

The Department of Mechanical Engineering strives to produce innovative engineers who will be successful in all advanced fields engineering and work for the betterment of the society.

Mission

 To impart quality education and produce engineers who can compete at the global level as a professional technocrat.
 To train the students in knowledge and skills to make them excel in higher studies.
 To disseminate skills to make the students take up entrepreneurship as a career.
 To make the students imbibe work culture and improve the quality of life.

Program Educational Objectives (PEO)

The program educational objectives of M.Tech in Manufacturing Technology and Automation are to

PEO 1	Create Globally Competent Manufacturing Engineers with Exposure to Scientific and Engineering aspects of Automation.
PEO 2	Create Sustained Interest in students in latest Automation Technologies of Manufacturing.
PEO 3	Enable Graduates with Strong Fundamentals and usage of appropriate latest automated manufacturing engineering tools.
PEO 4	Create and develop innovations in various manufacturing industries.

Program Outcomes (PO) of M.Tech (Manufacturing technology and automation)

After the successful completion of this program, the student will be able to

PO 1	Apply suitable techniques to machine variety of materials using advanced manufacturing methods.
PO 2	Acquire skill set to develop design of experiments, analysis and interpretation of data for the optimal solution of complex problems of manufacturing industries

PO 3	Design and analyse mobile robots and robot cell layouts.
PO 4	Learn the analytical skills for verifications and interpretations of FEA results of developed models.
PO 5	Develop codes for CNC machines using standard CAM packages.
PO 6	Apply additive manufacturing techniques for rapid prototyping.
PO 7	Apply the IoT, AI and ML based techniques to suit future industrial needs
PO 8	Apply basic project management skills, project team work and ethical behavior
PO 9	Prepare and present a technical report on automated systems in industry.
PO 10	Acquire knowledge in modern quality control techniques and inventory control principles

Programme Specific Outcomes (PSO)

After the completion of the course, the students will be able to acquire:

PSO1	An ability to apply knowledge and skill of various latest approaches in manufacturing technology and automation.
PSO2	The research based knowledge and research methods including design of experiments, analysis and interpretation of data and IT tools in manufacturing.
PSO3	An ability to automate a mechanical system or a process to meet desired needs within realistic constraints such as health, safety and manufacturability.

M.Tech. in MANUFACTURING TECHNOLOGY & AUTOMATION
Department of Mechanical Engineering
Effective from academic year 2020-21 admitted batch

Semester I

S.No	Course Code	Course Title	Category	L	T	P	C
1	20EME711	Manufacturing Automation	PC	3	0	0	3
2	20EME713	Advanced Materials Processing Technologies	PC	3	0	3	4.5
3	20EME715	Advanced Manufacturing Processes	PC	3	0	0	3
4	20EME707	Computer Aided Engineering	PC	3	0	3	4.5
5	20EME7XX	Program Elective I	PE	3	0	0	3
6	20EMC741	Research Methodology and IPR	MC	2	0	0	2
7	20EAC7XX	Audit Course I	AC	2	0	0	0
							20

Semester II

S.No	Course Code	Course Title	Category	L	T	P	C
1	20EME712	Intelligent Manufacturing systems	PC	3	0	0	3
2	20EME714	CNC and Robotics	PC	3	0	3	4.5
3	20EME716	Additive Manufacturing	PC	3	0	3	4.5
4	20EME8XX	Program Elective II	PE	3	0	0	3
5	20EME9XX	Program Elective III	PE	3	0	0	3
6	20EOE7XX	Open Elective	OE	3	0	0	3
7	20EME792	Technical Seminar	PC	0	0	4	1
8	20EAC7XX	Audit Course II	AC	2	0	0	0
							22

Semester III

S.No	Course Code	Course Title	Category	L	T	P	C
1	20EME881	Project Work-I	PW	0	0	26	13
							13

Semester IV

S.No	Course Code	Course Title	Category	L	T	P	C
1.	20EME882	Project Work-II	PW	0	0	26	13
							13

Number of Credits

Semester	I	II	III	IV	**Total**
Credits	20	22	13	13	**68**

PROGRAMME ELECTIVES _ M.Tech.(MT & A)

Programme ElectiveI

S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	20EME731	Mechatronics	PE	3	0	0	3
2	20EME733	Sensors for Intelligent Manufacturing	PE	3	0	0	3
3	20EME735	Optimization Methods in Engineering	PE	3	0	0	3
4	20EME737	Manufacturing Management	PE	3	0	0	3

Programme ElectiveII

S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	20EME832	Al and ML	PE	3	0	0	3
2	20EME834	Micro machining processes	PE	3	0	0	3
3	20EME836	IOT/IT in Manufacturing	PE	3	0	0	3
4	20EME838	Reliability and Failure Analysis	PE	3	0	0	3

Programme ElectiveIII

S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	20EME932	Total Quality Management	PE	3	0	0	3
2	20EME934	Design of experiments	PE	3	0	0	3
3	20EME936	Computer Integrated Manufacturing	PE	3	0	0	3
4	20EME938	Inventory Control	PE	3	0	0	3

Open Electives

S.No	Course Code	Course Title	Category	L	T	P	C
1	20EOE742	Business Analytics	OE	3	0	0	3
2	20EOE744	Industrial Safety	OE	3	0	0	3
3	20EOE746	Operations Research	OE	3	0	0	3
4	20EOE748	Cost Management Of Engineering Projects	OE	3	0	0	3
5	20EOE752	Waste To Energy	OE	3	0	0	3

Audit Course I and II

S.No	Course Code	Course Title	Category	L	T	P	C
1	20EAC741	English For Research Paper Writing	AC	2	0	0	0
2	20EAC742	Disaster Management	AC	2	0	0	0
3	20EAC743	Sanskrit For Technical Knowledge	AC	2	0	0	0
4	20EAC744	Value Education	AC	2	0	0	0
5	20EAC745	Constitution Of India	AC	2	0	0	0
6	20EAC746	Pedagogy Studies	AC	2	0	0	0
7	20EAC747	Stress Management By Yoga	AC	2	0	0	0
8	20EAC748	Personality Development Through Life Enlightenment Skills	AC	2	0	0	0
9	20EAC750	Developing Soft Skills and Personality	AC	2	0	0	0

20EME711: MANUFACTURING AUTOMATION

L	T	P	C
3	0	0	3

Course Description:

Through this course, students will get an exposure to automated manufacturing systems in and its importance in the modern automated factory. Automated manufacturing systems operate in the factory on the physical product. They perform operations such as processing, assembly, inspection and material handling. Manufacturing automation is the use of control systems, such as computers and information technologies for handling different processes and machines in an industry to replace a human being. Manufacturing automation improves the productivity and quality while reducing errors and waste, increasing safety and adds flexibility to the manufacturing process.

Course Objectives

- To learn various concepts of automation and work part transport mechanisms
- To study the assembly systems and to solve line balancing issues
- To understand the importance of latest numerical control machines and material handling systems
- To apply the concepts of part families and machine cells into various production systems
- To recognize the importance of automated inspection and to distinguish the various control systems

Unit-I **10 hours**

Over View of Manufacturing and Automation:Production systems, Automation in production systems, Automation principles and strategies,Reasons for Automation, Manufacturing operations, Functions in Manufacturing, Information processing in Manufacturing plant layout, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.Automation for machining operations.

Learning outcomes:

At the end of this unit, the student will be able to

- recognize the significance of automation in production **[L1]**
- examine the various configurations of transfer lines, features and how they work **[L3]**

Unit-II **7hours**

Assembly Systems and Line Balancing- Assembly process-Assembly lines-manual single stations assembly, Manual assembly line, automated assembly system-Line balancing.

Automated Assembly Systems – Design for automated assembly-Types of automated assembly systems-Parts feeding devices.

Learning outcomes:

At the end of this unit, the student will be able to

- explain the basic concepts of assembly process and the systems **[L2]**
- solve the line balancing problems **[L6]**

Unit-III **10 hours**

Automated Material Handling and storage system: Material Handling and Identification Technologies: Material handling, equipment, Analysis. Storage systems, performance and location strategies, Automated storage systems, AS/RS, types. Functions, material handling equipment-Conveyors, AGVS, Industrial Robots-Anatomy, Robot configurations, work volume-AS/RS. Automatic identification methods, Barcode technology, RFID.

Learning outcomes:

At the end of this unit, the student will be able to

- illustrate the fundamental concepts and operating characteristics of NC systems **[L4]**
- compare the various types material handling systems **[L5]**

Unit-IV **10 hours**

Manufacturing Systems and Automated Production Lines:Manufacturing systems: components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.Automated Assembly Systems:Fundamentals, Analysis of Assembly systems.

Learning outcomes:

At the end of this unit, the student will be able to

- examine the principles of manyfacturing systems **[L3]**
- design and develop the line balncing algorithms **[L5]**

Unit-IV **8 hours**

Quality Control and Support Systems:Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact and non-contact, CMM and machine vision techniques.

Control Systems-Introduction toConventional linear feedback control, Optimal control, sequence control and computer process control.

Learning outcomes:

At the end of this unit, the student will be able to

- examine the principles of automated inspection and sensor technologies **[L3]**
- analyze the various techniques of control systems **[L4]**

Text Books:

1. Milkell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Kindle Edition, Prentice Hall of India, 2016.
2. S. Mukhopadhyay, S.Sen and A.K. Deb, Industrial Instrumentation, Control and Automation, Jaico Publishing House, 2013.

References:

1. C. Roy, “Robots and Manufacturing Automation”, Asfahl John Wiley & Sons.
2. Krishna Kant, “Computer Based Industrial Control”, EEE-PHI, 2nd edition, 2010.
3. Viswanandham, ”Performance Modeling of Automated Manufacturing Systems”, PHI, 1st edition, 2009.
4. M.M.M. Sarcar, K. Mallikarjuna Rao, K. Lalit Narayan, Computer Aided Design and Manufacturing, Kindle Edition, PHI Learning, 2008.

Course Outcomes:

After the successful completion of this course, the student will be able to

1. apply principles and strategies of automation in manufacturing
2. select and identify suitable transfer mechanisms and assembly systems for the given application.
3. form machine cells based on the part families on the basis of design and manufacturing similarities.
4. implement the automatic inspection in number of alternative ways based on application.
5. differentiate various control aspects of automation.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1							1		3		3	1	3
2									3		2	1	3
3			1						2		2	1	2
4							1			3	2		2
5							1		1		3		2

1-Low, 2- Medium and 3- High Correlation

20EME713: ADVANCED MATERIALS PROCESSING TECHNOLOGIES

L	T	P	C
3	0	3	4.5

Course Description:

The purpose of this course is to develop an understanding of the principles, capabilities, limitations and applications of commonly used advanced materials processing technologies like nontraditional materials processing, fine finishing processes, metal forming, micro-machining and laser machining. The course is of parmount important in selecting an approporiate advanced technology in industry while processing materials based on type of material and its properties and the final requirements of the application.

Course Objectives

- To understand the principles, capabilities, limitations and applications of various non-conventional machining processes.
- To understand the principles of fine finishing process and their applications.
- To accumulate an idea about the advances in metal forming techniques.
- To become acquintance with fabrication techniques of micro devices.
- To understand the theory of lasers and application of laser for material processing.

Unit-I **8 hours**

Need of using advanced materials processing techniques in industry.

Advances in Non-Conventional Machining Processes: A brief review of non-conventional machining processes, Analysis of mechanical, thermal and Electrochemical type non-traditional machining processes. A comparative study of various processes.

Learning outcomes:

At the end of this unit, the student will be able to

- Explain the need of using advanced materials processing techniques in industry**. [L2]**
- Compare various important non-conventional machining processes. **[L4]**

Unit-II **8 hours**

Advanced Fine Finishing Process: Abrasive Flow Machining; Magnetic Abrasive Finishing; Magneto Rheological Abrasive Finishing: Process principle, process equipment; Applications.

Learning outcomes:

At the end of this unit, the student will be able to

- Explain the importance of finishing processes. **[L2]**
- Analyze various finishing processes and their applications **[L4]**

Unit-III **10 hours**

Advances in Metal Forming: High Energy Rate Forming techniques-Explosive forming, electro hydraulic forming, magnetic pulse forming, super plastic forming, rubber forming , flow forming - Principles and process parameters. Advantages -Limitations and Applications.

Learning outcomes:

At the end of this unit, the student will be able to

- Analyze different types of advanced metal forming techniques. **[L4]**

- Explain the process parameters, benefits, limitations and applications of advanced metal forming techniques. **[L2]**

Unit-IV **8 hours**

Fabrication of Micro-Devices: Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

Learning outcomes:

At the end of this unit, the student will be able to

- Analyze different types of fabrication of micro devices. **[L4]**

Unit-V **7 hours**

Laser Materials Processing: Fundamentals of industrial lasers. Laser materials interaction theories. Laser processing of metals, non-metals, photovoltaic and biomedical applications.

Learning outcomes:

At the end of this unit, the student will be able to

- Analyze different theories related to laser. **[L4]**
- Identify various applications of laser processing technique**. [L3]**

Text Books:

1. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 7th edition, Wiley India, 2019.
2. Serope Kalpakjian, Steven R Schmid, Manufacturing Engineering and Technology, 7th edition, Pearson Education, 2018.

References:

1. P.C. Pandey, H.S. Shan, Modern Machining Processes,. Tata McGraw-Hill Education, 2017.
2. Yogesh Jaluria, Advanced Materials Processing and Manufacturing, Springer, 2018.
3. Marc J. Madou , Fundamentals of Microfabrication and Nanotechnology, CRC Press, 2011.
4. Peter Schaaf, Laser Processing of Materials: Fundamentals, Applications and Developments, Springer, 2010.
5. T Jagadeesha,Non-Traditional Machining Processes, IK International Publishing, 2017.

Course Outcomes:

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

1. Understand the principles, capabilities, limitations and applications of various non-conventional machining processes.
2. Understand the principles of fine finishing process and their applications.
3. Acquire an idea about the advances in metal forming techniques.
4. Get acquintance with fabrication techniques of micro devices.
5. Understand and gain the capability of application of laser material processing techniques.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	3										3		2
2	3										3		2
3	3										3		2
4	3					2					3		2
5	3										3		2

1-Low, 2- Medium and 3- High Correlation

MATERIAL TESTING CHARACTERIZATION LAB

Course Description:

Objective is to give a broad understanding of common materials related to mechanical engineering with an emphasis on the fundamentals of structure-property-application relationships.

Course Objectives

The objectives of this course is to make students to learn:

- To learn the principles of material testing and characterization and to apply them for various engineering applications.
- Ability to apply knowledge of mathematics and engineering in calculating themechanical properties of structural materials.
- Ability to function on multi-disciplinary teams in the area of materialstesting.
- Ability to communicate effectively the mechanical properties of materials.

List of excecises:

1. On UTM static and dynamic properties evaluation Toughness, ductility, Resilience and stiffness

a. Tensile
b. Compression

2. Fatigue test
3. Forming Limit diagrams (FLD)
4. 3 - point bending test

5. 2-point bending test
6. Wear test on Pin on disc
7. Damping properties evaluation
8. Friction and Wear test on four ball tester
9. Micro structure characterization
10. Residual test

Course Outcomes

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

- Prepare the specimens for metallographic examination with best practice, can operate the optical microscope and understand, interpret, analyze the microstructure of materials .
- Classify the different mechanical testing methods with their inherent merits and limitations
- Apply various test methods for characterizing physical properties of materials.
- Recommend materials testing techniques based upon desired results, perform basic statistical analysis on data, and summarily present test results in a concise written format.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		1										1	
2		1										1	
3		1										1	
4		1										1	
5		1										1	

1-Low, 2- Medium and 3- High Correlation

20EME715: ADVANCED MANUFACTURING PROCESS

L	T	P	C
3	0	0	3

Course Description:

The course is an extension of manufacturing process and the students will have exposure to various concepts and philosophy of advanced manufacturing *process. This course provides an insight into different nontraditional machining process, surface treatment, microelectronic devices and processing of ceramic/composite materials so that machining and manufacturing of different materials can be done efficiently, accurately and cost effective way ,*

Course Objectives

- To acquainted with various surface treatment methods and unconventional manufacturing processes
- To know about the applications of advanced manufacturing processes
- To equip the students with various microelectronic devices
- To encourage the students for developing the models of Advanced Manufacturing Processes

Unit-I **9hours**

Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding

Learning outcomes:

At the end of this unit, the student will be able to

- recognize various surface treatment methods **[L1]**
- analyze and apply required technique **[L2]**

Unit-II **10hours**

Non-Traditional Machining: Introduction, need ,AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment ,process characteristics , performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR , Surface finish, WEDM

Learning outcomes:

At the end of this unit, the student will be able to

- recognize the difference between different Non-Traditional Machining process **[L1]**
- analyze and adapt suitable Non-Traditional Machining process to increase efficiency **[L3]**

Unit-III **10hours**

Laser Beam Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Plasma Arc Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electron Beam Machining - Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.

Learning outcomes:

At the end of this unit, the student will be able to

- understand the principle involved in Beam, Plasma Arc, Electron Beam and Electro Chemical Machining processes **[L1]**
- analyze the importance of Laser Beam, Plasma Arc, Electron Beam and Electro Chemical Machining processes as per constrained environment**[L4]**

Unit-IV **8hours**

Processing of ceramics : Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.

Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites

Learning outcomes:

At the end of this unit, the student will be able to

- have knowledge on processing of ceramics and composite materials**[L1]**
- Develop new ceramic and composite materials by enhancing their **[L5]**

Unit-V **8hours**

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics.

E-Manufacturing, nanotechnology, micromachining and High speed Machining.

Learning outcomes:

At the end of this unit, the student will be able to

- knowledge on microelectronic devices used in machining process **[L1]**
- Fabricate new machines by incorporating different Microelectronic devices.[**L5]**

Text Books:

1. Kalpakijian, Manufacturing Engineering and Technology, Adisson Wesley, Printice Hall of India, 1995.
2. Chang Liu, Foundation of MEMS, Pearson, 2012.

References

1. J. Mc Geough, Micro Machining of Engineering Materials, CRC Press.
2. Gary F Benedict, Non Traditional Manufacturing Processes, CRC Press.
3. J. A Mc Geough, Advanced Methods of Machining, Springer
4. V. K. Jain, Advanced Machining Processes, Allied Publications
5. R. A. Lindburg, Process and Materials of Manufacturing, 4th edition, PHI

Course Outcomes:

At the completion of the course, the students should able to

1. Describe the specific process characteristics of various advanced manufacturing technologies and identify their possible applications

2. Analyze and evaluate the benefits of advanced manufacturing processes and discuss their limitations
3. Able to understand different types of ceramic and composite material characteristics
4. Understand and fabricate microelectronic devices and use them during machining processes
5. Understand the e-manufacturing and nano materials.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	3										3		
2	3										3		
3	3										3		
4	3										3		
5	3										3		

1-Low, 2- Medium and 3- High Correlation

20EME707: COMPUTER AIDED ENGINEERING

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Description:

Computers have become inevitable in today era and find their application in various stages of product development. This course intends to introduce students to use of computers in the phases of product design viz. conceptualization, geometric modelling, graphical representation and finite element analysis. The concept of computer aided engineering using digital computers to control the various stages of engineering processes from the design. CAE demonstrates the usage of engineering mathematics related to geometry to understand concepts. This subject gives a scope for applying CAD concepts to product design and development. This course also exposes the students to deal with various modeling techniques and uses different numerical methods for solving a system of governing equations over the domain of a continuous physical system, which is discredited into simple geometric shapes called finite element.

Course Objectives

- To provides an overview of how computers are being used in mechanical component design.
- To impart knowledge on computer graphics which are used routinely in diverse areas as Science, engineering, medicine, etc.

- Acquire fundamental understanding of the principles of CAD, including engineering drawing, geometric and surface modeling, and feature-based design.
- To introduce the basic principles of finite element analysis.
- To demonstrate the methodology to model and solve complex problems in engineering.

Unit –I **8hours**

Introduction – Role of Computers in design and manufacture. Fundamentals of CAD: Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software. Introduction, Design process, Application of computer for design, creating the manufacturing database, Benefits of CAD, Design work station, CAD hardware.

- Understand the significance of CAD **[L1]**
- Comprehend the concept of graphic standards **[L2]**
- Utilize the CAD tools on workstation **[L3]**

Unit-II **12hours**

Introduction to Geometric Modelling: Requirement of geometric modelling, Geometric models, Geometric construction methods, Modelling facilities desired. Classification of wireframe entities andcurve representation methods. Classification of surface entities and Surface representation methods. Geometry, topology and Boundary representation. Solid modeling entities, Constructive solid geometry: CSG primitives and Boolean operators.

- Understand the significance of Geometric modelling **[L1]**
- Distinguish the different types of modeling techniques **[L2]**
- Analyze the representation of curves, surfaces and CSG primitives. **[L4]**

Unit-III

10hours Current developments in CAD – feature based modeling – Design by feature – function, feature linkages – Application of feature based models. Parametric modeling. Finite elements – mesh generation, modeling and post processing. Quality function deployment – Concept and its uses. Product design in concurrent engineering environment.

- Understand the need of feature based modeling **[L1]**
- Comprehend the concept of Quality function deployment **[L3]**
- Utilize the concept of parametric modeling **[L3]**

Unit-IV **8hours**

Introduction: Historical Perspective of FEM and applicability to mechanical engineering problems. **Fundamental Concepts**: Stresses and Equilibrium - Strain-Displacement relations - Stress-Strain relations - Plane stress and Plane strain - Temperature effects - Potential energy and Equilibrium - Raleigh-Ritz method - Galerkin's method.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the significance of FEM **[L1]**
- Comprehend the concept of plane stress and strain **[L4]**
- Utilize the concept of energy methods **[L5]**

Unit-V **10hours**

One-dimensional Problems: Finite element modeling coordinates and Shape functions - Assembly of the global stiffness matrix - mass matrix and load vector - Treatment of boundary conditions - Temperature effects - Plane trusses

Beams: Finite element formulation - Load vector - Boundary considerations - Shear force and bending moment

Learning Outcomes:

At the end of this unit, the student will be able to

- Comprehend the concept Finite element modelling **[L2]**
- Analyze the bars and trusses by treatment of boundary conditions. **[L4]**
- Evaluate the shear force and bending moment of Beams. **[L5]**

Text Books:

1. M.M.M. Sarcar, K. Mallikarjuna Rao, K. Lalit Narayan, Computer Aided Design and Manufacturing, Kindle Edition, PHI Learning, 2008.
2. Ibrahim Zeid and R Sivasubramanian, CAD/CAM : Theory and Practice: Special Indian Edition, McGraw Hill Education; 2nd edition, 2009.
3. Tirupathi.R.Chandrupatla, Ashok.D.Belegundu, Introduction to Finite Elements in Engineering, 4th edition , Pearson Education Limited, 2015.

References:

1. J. N. Reddy, An introduction to the finite element method, 3rd edition, McGraw-Hill Education, 2005.

Course Outcomes:

At the completion of the course, the students should able to

1. Get an overview of how computers are being used in mechanical component design.
2. Acquire knowledge on computer graphics which are used routinely in diverse areas as Science, engineering, medicine, etc.
3. Acquire fundamental understanding of the principles of CAD, including engineering drawing, geometric and surface modeling, and feature-based design.
4. Acquire the basic principles of finite element analysis.
5. Learn to demonstrate the methodology to model and solve complex problems in engineering.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		2		3								2	
2		2		3								2	
3		2		3								2	
4		2		3								2	

5		2		3								2	

1-Low, 2- Medium and 3- High Correlation

COMPUTER AIDED ENGINEERING LAB

Course Description:

The objective of Laboratory course on Computer Aided Engineering is introduce to the use of modern computational tools used for design and analysis. Primary focus is on product design with solid modeling and finite-element analysis. Software used is representative of that found in industry. Topics such as 2-D and 3-D drawing, tolerance specification, and FEA validation are also covered.

Course objectives

- Understand the basic steps solid modeling
- Understand the basic concept of feature-based, parametric, and solid modeling.
- Be able to construct 3-D solid models, 2-D drawing, assembly and sub-assembly structure.
- Be able to generate 2-D and 3-D models for finite element analysis.
- Understand the basic concepts of modeling for analysis and manufacturability.
- To present an overview of Computer Aided Engineering (CAE) and describe its applications in different fields.
- To introduce the advanced capabilities of CAD and how they can be used to increase productivity.

List of excecises:

A. Introduction to Modeling packages – Pro-Engineer, Ideas, CATIA, Unigraphics, Solid Works.
1. 2D-drawings using sketcher options - 3 Exercises
2. 3D-modelling using form features - 3 Exercises

B. Introduction to pre-processing software - Hyper mesh
3. 2D-Meshing and 3D-Meshing - 4 Exercises

C. Introduction to Finite Element Analysis software – ANSYS / NISA / Nastran
4. Static Structural Analysis of 1D problems – bars, trusses, beams and frames
5. Static Structural Analysis of 2D problems – plane stress, plane strain, axisymmetric
6. Static Structural Analysis of 3D problems – various brackets
7. Dynamic Structural Analysis of 1D problems – beams and frames
8. Steady State Thermal Analysis of 1D and 2D models
9. Transient Thermal Analysis of 1D and 2D models
10. Couple Field (Thermal/Structural) Analysis

Course Outcomes

1. Apply mathematical skills in the design and analysis of model generations and analysis.
2. Exercise analytical skills in model verifications and interpretations of FEA results.

3. Apply knowledge from component design in projects.
4. Students will be trained on Industry-standard software packages and analytical tools are used intensively in design projects.
5. Learn to introduce the advanced capabilities of CAD and how they can be used to increase productivity.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1			3		2							2	
2			3		2							2	
3			3		2							2	
4			3		2							2	
5			3		2							2	

1-Low, 2- Medium and 3- High Correlation

20EME712: INTELLIGENT MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

Course Description:

Manufacturers are increasingly utilizing machine tools that are self-aware – they perceive their own states and the state of the surrounding environment – and are able to make decisions related to machine activity processes. This is called intelligent manufacturing, and through this course students will receive a primer on its background, tools and related terminology.

Course Objectives

- The objective of this course is to learn the statistics and optimization methodologies in intelligent manufacturing systems.
- The students will know how to apply artificial intelligence (AI) and data mining (DM) techniques to solve the real problems in shop-floor level or capacity planning problems.

Unit- I **10hours**

Computer Integrated Manufacturing Systems Structure and functional areas of CIM system – CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems – MAP/TOP, OSI Model, Data Redundancy, Top- down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the need of computer integrated systems in intelligent manufacturing. [L1]
- Comprehend the concept of Intelligent Manufacturing systems. [L2]

Unit-II **10hours**

Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

Learning Outcomes:

At the end of this unit, the student will be able to

- Transfer the knowledge from expert systems to machining operations. [L3]
- Demonstrate the various schemes of knowledge based systems. [L2]

Unit-III **8hours**

Machine Learning: Concept, Artificial Neural Networks, Biological and Artificial Neuron, Types of Neural Networks, Applications in manufacturing. Use of probability and fuzzy logic for machine thinking.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of machine learning and ANN. [L1]
- Experiment fuzzy logic to make machine to think. [L4]

Unit-IV **10hours**

Knowledge Based Group Technology: Group Technology: Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method. Knowledge Based Group Technology – Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBST) — Data Base, Knowledge Base, Clustering Algorithm.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the different models and algorithms of Group Technology.**[L1]**
- Apply the knowledge of KBST for manufacturing processes. **[L5]**

Unit-V **8hours**

Industrial applications of AI: Intelligent system for design, equipment selection, scheduling, material selection, maintenance, facility planning and process control.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the importance of Artificial intelligence **[L1]**
- Examine the various industrial application of AI. **[L4]**

Text Books:

1. A. B. Badiru, Expert Systems Applications in Engineering and Manufacturing, Prentice-Hall, New Jersey, 1992.
2. Andrew Kussiak, Intelligent Manufacturing Systems, Prentice Hall, 1990.

References:

1. Artificial Neural Networks/ Yagna Narayana/PHI/2006
2. Automation, Production Systems and CIM / Groover M.P./PHI/2007
3. Neural networks: A comprehensive foundation/ Simon Haykin/ PHI.
4. Artificial neural networks/ B. Vegnanarayana/PHI

Course Outcomes:

At the completion of the course, the students should able to

1. Summarize the concepts of computer integrated manufacturing systems and manufacturing communication systems
2. Understand the basic components of robots and its industrial applications.
3. Demonstrate the concepts of artificial intelligence in automated process control.
4. Select the manufacturing equipment using knowledge based system for equipment selection.
5. Apply various methods to solve group technology problems and demonstrate the structure for knowledge based system for group technology.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		3					3					3	
2		3					3					3	
3		3					3					3	
4		3					3					3	
5		3					3					3	

1-Low, 2- Medium and 3- High Correlation

20EME714: COMPUTER NUMERICAL CONTROL AND ROBOTICS

L	T	P	C
3	0	3	4.5

Course Description:

This course exposes the students to understand the standard terminologies, conventions, processes, operations, design and operational characteristics of key hardware components, programming techniques, applications, merits and demerits of computer numerical control (CNC) machines. This course helps the students to develop the programming skills, able to operate the CNC machines so that the need of automation in manufacturing industries can be satisfied. The course also focuses on robotics is intended to provide a reasonable understanding of robotics, how they function, industrial applications and also involves controlling the robot using motors, controllers etc.

Course Objectives

- To introduce the basic concepts in numerical control, CNC and DNC machine tools.
- To familiarize the knowledge regarding adaptive control of CNC machines.
- To expose the students to automatic/computer assisted NC tool path programming using G codes and M codes as well as APT tools language for machining operations.
- To familiarize the importance of robot and its applications.
- To acquire knowledge related to Robot cell Design, Drives and Controls

Unit- I **10hours**

Introduction: NC, DNC, CNC, Programmed Automations, Machine control unit, Part program, NC tooling. NC machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centers, Automatic tool changes (ATC), Turning centers. Machine control unit & tooling: Functions of MCU, NC actuation systems, Part program to command signal, MCU organization, Computerized numerical control, Transducers for NC machine tools, Tooling for NC machining centers and NC turning machines, Tool presetting.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of NC, CNC and DNC systems. [L1]
- Differentiate between CNC machine and machining centers. [L2]

Unit-II **10hours**

Manual part programming: Part program instruction formats, Information codes: Preparatory function, Miscellaneous functions, Tool code and tool length offset, Interpolations, Canned cycles, Manual part programming for milling operations, turning operations, parametric subroutines.

Learning Outcomes:

At the end of this unit, the student will be able to

- Prepare part programs for machining operations using G-codes and M-codes. [L2]
- Learn the advanced part programming features like parametric subroutines. [L3]
- Operate the CNC machines to manufacture the parts. [L6]

Unit-III **12hours**

APT programming: APT language structure, APT geometry: Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to-point motion commands, continuous path motion commands. Post processor commands, complication control commands, Macro subroutines, Part programming preparation for typical examples. Other popular part programming languages like: APT, NELAPT, EXAPT, GNC, VNC, Preprocessor, Post processor.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the concept of APT programming language. [L1]
- Develop the APT part programs for typical examples. [L3]

Unit-IV **10hours**

Introduction to Robotics: Definition need and scope of industrial robots, robot anatomy, work volume, precision movement and end effectors.

Robot Cell Design and Application: Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis, Industrial application of robots.

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the significance of robotics **[L1]**
- Acquaint the knowledge of robot work cell design and control **[L2]**
- Applicability of robot cycle time analysis in industries **[L5]**

Unit-V **8hours**

Robot Drives and Control: Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the significance of drives and controls in robots **[L1]**
- Utilize the concept of different end effectors and grippers **[L3]**

Text Books:

1. M.M.M. Sarcar, K. Mallikarjuna Rao, K. Lalit Narayan, Computer Aided Design and Manufacturing, Kindle Edition, Printice Hall of India, 2008.
2. P.N.Rao, CAD/CAM: Principles and Applications, 3rd edition, McGraw Hill Education, 2017.
3. S.R. Deb, Robotics Technology and Flexible Automation, 2nd edition, Tata McGraw-Hill, 1994.

References:

6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,Industrial Robotics Technology, Programming and Applications, 1st edition,McGraw-Hill, Int. 1986.

7. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, Robotics Engineering – An Integrated Approach, 1st edition, Prentice-Hall of India Pvt. Ltd., 2009
8. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, July, 1987

Course Outcomes:

At the completion of the course, the students should able to

1. The students will gain an experience in the implementation of manual part programming as a part of industrial automation **[L4]**
2. Understand the basic components of robots and its industrial applications. **[L1]**
3. Differentiate the actuators, drives and grippers for a robot based on specific application **[L2]**
4. Analyze the principles of operation for mobile robots and robot cell layout. **[L4]**
5. Acquire knowledge related to Robot cell Design, Drives and Controls

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	1		3										3
2	1		3										3
3	1		3										3
4	1		3										3
5	1		3										3

1-Low, 2- Medium and 3- High Correlation

COMPUTER NUMERICAL CONTROL AND ROBOTICSLAB

Today's manufacturing utilizes innovative technologies, including sophisticated Computer numerical control (CNC), Computer Aided Manufacturing (CAM) software and specialty industry materials to develop and build the products of tomorrow. This course also covers fundamentals of robot working, programming and integration in a manufacturing process. It starts with examples of robotics idea over history and continue with a numerous of examples in nowadays robot applications on different areas of human activities.

Students will be walked through all aspects of CNC machining, how to import a CAD model in to CAM software, how to get it ready for machining and how to apply machining techniques to machine that part. At the end students will spend some time on the machine learning how to machine a part on a CNC milling machining center. This last step is critical to put together pieces of the puzzle, so that one can understand the whole process. Students will be applying machining

techniques in the virtual world and then apply and see how a virtual object comes in to reality on a CNC machine.

Course Objectives

- To make students aware of CNC machining process.
- To teach basic concepts of CNC Programing using CAM software.
- How to Setup a CNC machine and machine a part.
- Use of CNC machines other than machining.

List of experiemnts:

1. Preparation of manual part programme for turning, drilling and milling
2. To Generate NC programme using Master CAM simulation software for a turning Job using Lathe Version.
    a) Step turning, taper turning, drilling
    b) Thread cutting, grooving,
3. To Generate NC programme using Master CAM simulation software for a 3-axis machining Milling Version.
    a) Face milling, pocketing, drilling, contouring
    b) Gear cutting.
4. To Generate NC & APT programme using CATIA Manufacturing software for Lathe Machine.
5. To Generate NC & APT programme using CATIA Manufacturing software for Prismatic Machining.
6. Machining of one job on CNC Lathe.
7. Machining of one job on CNC Drilling.
8. Study the robotic arm and its configuration
9. Study of robotic end effectors
10. Robot programming through computer / teaching box method.

Course Outcomes

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

1. Modeling of simple machine parts and assemblies from the part drawings using standardCAD packages.
2. Generate CNC Turning, Drilling and Milling codes for different operations using standard CAM packages.
3. Write manual part programming using ISO codes for turning, drilling and milling operations
4. explain the fundamentals of robotics and its components
5. robot configuration and subsystems
6. principles of robot programming and handle with typical robot

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1					3	2						2	
2					3	2						2	
3					3	2						2	
4					3	2						2	
5					3	2						2	

1-Low, 2- Medium and 3- High Correlation

20EME716: ADDITIVE MANUFACTURING

L	T	P	C
3	0	3	4.5

Course Description:

Additive manufacturing (AM), broadly known as 3D printing, is transforming how products are designed, produced, and serviced. AM enables on-demand production, without dedicated equipment or tooling, and unlocks digital design tools, giving breakthrough performance and unparalleled flexibility. Across industries, knowledge remains one of the greatest barriers to AM's wider adoption.

Course Objectives

- Demonstrate the broad range of AM processes, devices, capabilities
- Expose the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
- Analyze the different processes in rapid prototyping systems.
- Explain about mechanical properties and geometric issues relating to specific rapid prototyping applications.

Unit I **10 hours**

Introduction: Overview – History - Need-Classification -Additive Manufacturing Technology in product development- Materials for Additive Manufacturing Technology – Distinction between AM & CNC machining, Advantages of AM, Tooling - Applications.

Classification of AM processes: Liquid polymer system, discrete particle system - molten material systems - solid sheet system.

Learning Outcomes:

At the end of this unit, the student will be able to

- demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies. [**L-1**]
- describe different RP techniques. [**L-3**]
- discuss fundamentals of Reverse Engineering. [**L-3**]

Unit II **8 hours**

CAD for Additive Manufacturing: Conceptualization, CAD model preparation – conversion to STL - STL file manipulation - Part Orientation and support generation – Model Slicing –Tool path Generation – Transfer to AM - Machine setup, build , removal and clean up, post processing. Data Processing for Additive Manufacturing Technology - Softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

Learning Outcomes:

At the end of this unit, the student will be able to

- recognize the significance of softwares for additive Manufacturing Technology. [**L-1**]
- utilize the concept of 3D printing. [**L-3**]
- calculate the time required to perform a job **[L-2]**
- Processes related to AM, such as 3D scanning, mold-making, casting and sintering. **[L-2]**

Unit III **8 hours**

Liquid Based and Solid Based Additive Manufacturing Systems: Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system – Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the significance of Liquid based systems in 3D design. [**L-1**]
- calculate the material required for making of an actual part. [**L-3**]
- differentiate the object manufacturing to utilize the concepts [**L-3**]

Unit IV **8 hours**

Powder Based Additive Manufacturing Systems: Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications - Laser Engineered Net Shaping (LENS), Electron Beam Melting.

Learning Outcomes:

Upon successful completion of the course, the students will be able to

- differentiate the SLS process
- select between a subtractive and an AM process for a particular application. [**L-1**]
- select a particular AM process. [**L-3**]
- take a career in research or in advanced manufacturing, the AM being a rapidly evolving area and with wide applications. [**L-4**]

Unit V **8 hours**

Medical And Bio-Additive Manufacturing: Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies.

Learning Outcomes:

Upon successful completion of the course, the students will be able to

- select between a subtractive and an cage process for a particular application. [**L-1**]
- select the ability of to make GATE a activity . [**L-3**]

- take a career in research or in advanced manufacturing, the AM being a rapidly evolving area and with wide applications. [**L-4**]

Text Book(s)

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.

References

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2007.
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", CRC press, 2000.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. select between a subtractive and an AM process for a particular application. **[L1]**
2. select a particular AM process**. [L- 5]**
3. take a career in research or in advanced manufacturing, the AM being a rapidly evolving area and with wide applications.[L-3]
4. ready for product development of engineering components and for entrepreneurship. **[L-5]**
5. employ RE for value addition and reproduction of parts. **[L- 4]**

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	3					3	1				1		
2		2			3	1	3				1	3	3
3	2	2				3	1				3	1	
4	2	2				3	1				3	1	
5	3	2				3	1				3	2	1

1-Low, 2- Medium and 3- High Correlation

ADDITIVE MANUFACTURING LAB

Course Description:

The objective of the Laboratory course on additive manufacturing is to impart fundamentals of additive manufacturing processesalong with the various file formats, software tools, processes, techniques and applications.

Course Objectives

- To exploit technology used in additive manufacturing.
- To understand importance of additive manufacturing in advance manufacturing process.
- To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
- To explore the potential of additive manufacturing in different industrial sectors.

List of experiments:

1. Introduction to Additive Manufacturing
2. CAD softwares for Additive Manufacturing
3. Generating STL files from the CAD Models & Working on STL files
4. Modeling Creative Designs in CAD Software
5. Processing the CAD data in Catalyst and CURA softwares
6. Simulation in Catalyst Software for optimizing build-time and material consumption
7. Sending the tool path data for fabricating the physical part on RP machine
8. Removing the supports & post processing (cleaning the surfaces)
9. Evaluating the quality of the fabricated part in terms of surface finish and dimensional accuracy.
10. Evaluating the fabricated part for its suitability to a given application

Course Outcomes

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

1. Define, Analyze and select suitable processes and materials used in Additive Manufacturing.**[L-2]**
2. Simulation in Catalyst Software for optimizing build-time and material consumption **[L-4]**
3. Able to apply knowledge of additive manufacturing for various real-life applications. Able to apply techniques of CAD and reverse engineering for geometry transformation in Additive Manufacturing. **[L-4]**
4. Able to understand removing the supports & post processing **[L-3]**
5. Testing the developed 3D printed parts. **[L-5]**

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	3					3					3	1	
2		2			2	3	2		1		3	2	1
3	2	2			3	3	3		1		2	2	3
4	1				1	3	2				3	3	3
5						1	1		2		3	3	3

1-Low, 2- Medium and 3- High Correlation

20EME731: MECHTRONICS

L T P C
3 0 0 3

Course Description:

Mechatronics, which is also called mechatronic engineering, is a multidisciplinary branch of engineering that focuses on the engineering of both electrical and mechanical systems, and includes a combination of robotics, electronics, computer, telecommunications, systems, control, and product engineering. As technology advances over time, various subfields of engineering have succeeded in both adapting and multiplying. The intention of mechatronics is to produce a design solution that unifies each of these various subfields. Originally, the field of mechatronics was intended to be nothing more than a combination of mechanics and electronics, hence the name being a combination of mechanics and electronics; however, as the complexity of technical systems continued to evolve, the definition had been broadened to include more technical areas.

Course Objectives

Mechatronics and appreciate its relevance in engineering design To understand the working of modern mechanical system, deals with sensors, actuators and controllers in specific

- Sensors and Transducers and Actuation Systems
- System Models and Controllers
- Programming Logic Controllers and Design of Mechatronics Systems

Unit- I MECHATRONICS, SENSORS AND TRANSDUCERS 9 hours

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Displacement, Potentiometer LVDT – Encoders – Hall Effect – Capacitive Transducers Microprocessor based Controllers - Applications. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, (thermistor, thermocouple) Light Sensors – Selection of Sensors.

Learning outcomes:

At the end of this unit, the student will be able to

- Understand the significance of mechatronics and appreciate its relevance in engineering design **[L1]**
- Explain the system and define the elements of measurement systems **[L2]**
- Describe and evaluate the commonly used sensorsand Transducers **[L3]**

Unit-II ACTUATION SYSTEMS 9 hours

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and Pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors - Servomotors.

Learning outcomes:

At the end of this unit, the student will be able to

- Interpret and design simple systems involving hydraulic/pneumatic directional control valves and cylinders. **[L4]**
- Determine and Evaluate the capabilities possible mechanical actuation systems **[L5]**
- Evaluate the operational characteristics of electrical actuation systems **[L6]**
- Explain the principles of d.c. motors and a,c, motors and how it can have its speed controlled. **[L7]**

UNIT- III SYSTEM MODELS AND CONTROLLERS 9 hours

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems.

Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

Learning outcomes:

At the end of this unit, the student will be able to

- Explain the importance of models in predicting the behaviour of Mechanical, Electrical, Fluid and Thermal Systems. **[L8]**
- Describe how various controllers can operate. **[L9]**

UNIT- IV PROGRAMMING LOGIC CONTROLLERS 9 hours

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC Problem – Application of PLCs for control

- Describe the basic structure of PLCs and their operation. **[L10]**
- Develop programs for a PLC involving logic functions, latching, internal relays and sequencing. **[L11]**
- Develop programs involving timers, counters, shift registers, master relays, jumps and data handling. **[L12]**

UNIT- V DESIGN OF MECHATRONICS SYSTEM 9 hours

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case Studies of Mechatronics Systems, Pick and place robot – Automatic Car Park Systems – Automatic Camera – Automatic Washing Machine - Engine Management Systems.

- Develop possible solutions to design problems when considered from the mechatronics point of view. **[L12]**
- Analyse case studies of mechatronics solutions. **[L13]**

Text book(s):

1. Bolton, W. "MechatronTics", Pearson Education, 6th Edition, 2015.
2. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2005.
3. Ramachandran, K.P., Vijayaraghavan, G.K.and Bala Sundaram, M.S. "Mechatronics: Integrated "Mechanical Electronic System" Wiley India Pvt Ltd.

References:

1. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall
2. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
3. Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.

Course outcomes

After successful completion of the course, the students should be able to

1. Classify various sensors, transducer and actuators according to the applications.
2. Explain various system models and controllers.
3. Select a controller for a mechanical and mechatronics system.
4. Program logic controls
5. Design a mechatronic system

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1				2	1							1	
2				2	1							1	
3				2	1							1	
4				2	1							1	
5				2	1							1	

1-Low, 2- Medium and 3- High Correlation

20EME733: SENSORS FOR INTELLIGENT MANUFACTURING

L	T	P	C
3	0	0	3

Course Description:

This course is designed to make students familiar with the constructions and working principle of different types of sensors and transducers. The introduction of this course is to make students aware about the measuring instruments and the methods of measurement and the use of different transducers/ This will make the students understand the Identification, classification, construction, working principle and application of various transducers used for Displacement measurement, Temperature measurement, Level measurement, and Miscellaneous measurement. There are also some basic principles and techniques of micro sensors and actuators. This course also introduces the concepts of Industrial Internet of Things, and Cloud Computing. The students are exposed to the architectures, and various frameworks in IoT and Cloud Computing.

Course Objectives:

1. To gain knowledge about the measuring instruments and the methods of measurement and the use of different transducers.
2. To describe the working principles of different types of sensors.
3. To evaluate the technological and physical limitations of a specific sensor.
4. To propose a suitable sensor for a given measurement situation.
5. To design an integrated sensor system with different types of sensors.

Unit-I **9 hours**

Resistance Transducer-Basic principle – Potentiometer – Loading effects, Resolution, Linearity, Resistance strain gauge –Types – Resistance thermometer – Thermistors – characteristics, Thermocouple –Compensation circuits – junction and lead compensation, merits and demerits. Inductance Transducer:- Basic principle – Linear variable differential transformer - RVDT-Synchro – Induction potentiometer-variable reluctance accelerometer-microsyn. Torque measurement on rotating shafts – shaft power measurement (dynamometers)

Learning outcomes:

- Gives understandings of basics of sensors and transducers. **[L-5]**
- To remember the variety of resistance and inductance based sensors. **[L-6]**
- To evaluate the performance of resistance type transducer. **[L-2]**

Unit-II **9 hours**

Capacitance Transducer – Basic principle- transducers using change in area of plates - distance between plates- variation of dielectric constants-frequency response - Piezoelectric transducer-Basic principle, Mode of operation - properties of piezoelectric crystals-loading effect, Magnetostrictive Transducer- Hall effect transducer

Learning outcomes:

- Gives understandings of basics of capacitance type transducers. **[L-5]**
- To remember the mode of operation of piezo-electric based sensors. **[L-6]**

Unit-III **9 hours**

Introduction – Role of sensors in manufacturing automation – operation principles of different sensors – electrical, optical, acoustic, pneumatic, magnetic, electro-optical and vision sensors.

Learning outcomes:

- To understand the role of sensor in Intelligent Manufacturing. **[L-5]**
- To evaluate the performance of various transducer. **[L-2]**

Unit-IV **9 hours**

Condition monitoring of manufacturing systems – principles – sensors for monitoring force, vibration and noise, selection of sensors and monitoring techniques. Acoustic emission – principles and applications – concepts of pattern recognition.

Learning outcomes:

- To apply condition monitoring in Intelligent Manufacturing system. **[L-4]**
- To understand the concept of pattern recognition. **[L-5]**

Unit-V **9 hours**

Sensors for CNC machine tools – linear and angular position and velocity sensors. Automatic identification techniques for shop floor control – optical character and machine vision sensors – smart / intelligent sensors – integrated sensors, Robot sensors, Micro sensors, Nano sensors. Manufacturing of semiconductor sensors and fibre optic sensors – principles, applications.

Learning outcomes:

- To apply the sensors for CNC machine tools. **[L-4]**
- To analyse the techniques for shop floor control. **[L-3]**
- To evaluate the performance of types of sensors in Intelligent Manufacturing. **[L-2]**

Text Books:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill
4. Fundamentals of Photonics, B. Saleh, John Wiley& Sons
5. Fiber optic Sensors, E. Udd, John Wiley& Sons
6. S. Jeschke, C. Brecher, H. Song, and D. B. Rawat, Industrial Internet of Things: Cybermanufacturing Systems, Springer, 1st edition, 2017, ISBN: 978-3319425580

Course Outcomes:

1. To get the basic idea of measurements and the errors associated with measurement.
2. To differentiate between the types of transducers available
3. To gain information about the function of various measuring instruments and using them
4. To propose a suitable sensor for a given measurement situation.
5. To design an integrated sensor system with different types of sensors.

CO-PO MAPPING

	POs	PSOs

CO	1	2	3	4	5	6	7	8	9	10	1	2	3
1		1					1					1	
2		1					1					1	
3		1					1					1	
4		1					1					1	
5		1					1					1	

1-Low, 2- Medium and 3- High Correlation

20EME735: OPTIMIZATION METHODS IN ENGINEERING

L	T	P	C
3	0	0	3

Course Description:

This course exposes the evaluation of best possible solution for various engineering planning and design problems. The aim of the course is to train the students to develop a mathematical model and to solve the model by applying an appropriate mathematical programming technique. This course covers all advanced optimization techniques like geometric, dynamic, integer, stochastic and unconventional optimization techniques.

Course objectives

- To illustrate the importance of advanced optimization techniques in theory and practice.
- To formulate and solve engineering design problems in the industry for optimal results
- To test the analytical skills in solving realistic engineering problems by applying appropriate optimization technique.
- To demonstrate various advanced and unconventional optimization techniques being developed in recent times.
- To develop and promote research interest in problems of Engineering and Technology

Unit-I **12 hours**

Geometric programming (G.P): Unconstrained minimization problem, Solution of an unconstrained geometric programming, differential calculus method and arithmetic method, Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P), Complementary Geometric Programming, constrained minimization.

Learning Outcomes:

At the end of this module, the student will be able to

- Formulate the geometric programming problem (**L5**)

- Evaluate the optimal solution to geometric programming problem(**L6**)

Unit-II **10 hours**

Dynamic programming (D.P): Multistage decision processes, Concepts of sub optimization, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P and Continuous D.P.

Learning Outcomes:

At the end of this module, the student will be able to

- Formulate the given linear/non-linear programming problem as a dynamic programming problem(**L5**)
- Evaluatethe optimal solution to dynamic programming problems using multi-stage decision process (**L6**)

Unit-III **12 hours**

Integer programming (I.P): Integer linear programming, Graphical representation, Gomory's cutting plane method, Bala's algorithm for zero-one programming problem, Integer non linear programming, Branch-and-bound method, sequential linear discrete programming, generalized penalty function method

Learning Outcomes:

At the end of this module, the student will be able to

- **Formulate** the integer and/or binary programming problem (**L5**)
- **Evaluate** the optimal solution to integer and/or binary programming problem (**L6**)

Unit-IV **10 hours**

Stochastic Programming (S.P): Basic concepts of Probability Theory, Stochastic linear programming, stochastic non-linear programming.

Learning Outcomes:

At the end of this module, the student will be able to

- **Define** random variables and **Formulate** the stochastic programming problem (**L1&L5**)
- **Analyze** the optimal solution to given problem under uncertainty (**L4**)

Unit-V **12 hours**

Unconventional optimization techniques: Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated Annealing, Neural Networks based Optimization.

Learning Outcomes:

At the end of this module, the student will be able to

- **Formulate** the multi-variable optimization problem (**L5**)
- **Evaluate** the optimal solution to multi-variable optimization problem (**L6**)

Text Book:

1. Rao S.S., Engineering Optimization - Theory and Practice, 3rd edition, New Age International (P) Ltd. Publishers, 1996.

References:

1. Ravindran, Phillips and Solberg, Operations Research- Principles and Practice, 2nd edition, JohnWiely, 2007.

2. Hiller and Lieberman, Introduction to Operations Research, 7th edition, McGraw Hill, 2002.
3. James P. Ignizio, Goal Programming and Extensions, 2nd edition, Lexigton Books, 1976.
4. David E. Goldberg, Genetic Algorithms - In Search, Optimization and Machine Learning, 1st edition, Addison-Wesley Longman (Singapore) Pvt. Ltd., 1989.

Course outcomes

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

1. to formulate and solve geometric programming problems (**L5&L3**)
2. to solve any complex optimization problem as a dynamic programming problem and analyze its solution(**L3&L4**)
3. to recognize the significance of integer and/or binary solutions and apply suitable algorithm for better decision making(**L1&L3**)
4. to formulate and solve stochastic optimization problems for decision making under uncertainty(**L5&L3**)
5. to formulate and solve multi-objective optimization problems; to propose various modern unconventional optimization techniques. (**L5&L3**)

CO-PO MAPPING

	POs										**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		**3**										3	
2		3										3	
3		3										3	
4		3										3	
5		3										3	

1-Low, 2- Medium and 3- High Correlation

20EME737: MANUFACTRUING MANAGEMENT

L	T	P	C
3	0	0	3

Course Description:
Manufacturing management is intended to introduce the new domains of operations management. In today's competitive business environment, mangers in the manufacturing sector are faced with unique leadership challenges which is further compounded by a shortage of people with competency essentials to high growth industries.

Course Outcome

- Understand the elements of competitive manufacturing strategy
- Design the processing system for product/service
- Prepare capacity and material plans
- Understand the elements of Just in time manufacturing
- Locate lay out facilities and understands the elements of lean and agile manufacturing

Unit-I **8 hours**

Manufacturing strategy – competitiveness, strategy and productivity – Strategy formulation process – strategic options – SWOT Analysis – world class manufacturing practices – Operations strategy in global economy

Learning Outcomes:
At the end of this module, the student will be able to

- Understand the elements of competitive manufacturing strategy**[L2]**
- Apply SWOT analysis for betterment of the process and their strategies[**L3]**
- Analyze the implementation of world class manufacturing practices[**L4]**
- Evaluate the objectives of the change in various manufacturing related metrics and accordingly manage the operations**[L5]**

Unit-II **8 hours**

System design – product and service design – process design issues – strategic capacity planning for products and services – facility location – factors affecting location

Learning Outcomes:
At the end of this module, the student will be able to

- Understand the design of product and their service issues**[L2]**
- Analyze the strategies for capacity planning of products and their services**[L4]**
- Evaluate the factors affecting location and facilities for capacity planning **[L5]**
- Create an coordinate mechanism with product development teams to achieve design for manufacturability**[L6]**

Unit-III **9 hours**

Planning and control of operations – strategies for aggregate production planning – resources planning – materials requirements planning – MRP System – Capacity requirements planning – manufacturing resources planning (MRP II) – Enterprise resources planning

Learning Outcomes:

At the end of this module, the student will be able to

- Understand the need for production planning strategies and MRP system**[L2]**
- Analyze the planning of material, capacity and resource **[L4]**
- Evaluate the resources and capacity planning**[L5]**

Unit-IV **7 hours**

Just in time and lean operations – Elements of JIT manufacturing – Lot size reduction – Kanban production information system - push and pull scheduling – JIT as a business philosophy

Learning Outcomes:

At the end of this module, the student will be able to

- Understand the concept and elements of Just-in-time manufacturing**[L2]**
- Apply Kanban production information system**[L3]**
- Analyze the JIT as the philosophy of business**[L4]**

Unit-V **8 hours**

Layout – demerits of products and process layout – cellular manufacturing –flexible manufacturing. Elements of lean production-Introduction to agile manufacturing

Learning Outcomes:

At the end of this module, the student will be able to

- Remember different types of layouts and their functioning **[L1]**
- Understand the functioning of different types of lean and agile manufacturing methods**[L2]**
- Apply sustainable manufacturing methods to obtain acceptable products**[L3]**
- Evaluate different manufacturing layouts and adopt the suitable manufacturing method**[L5]**

Text book(s):

1. William J Stevenson, Operations management, Tata McGraw Hill
2. Nicholas, J.M., Competitive Manufacturing Management, Tata McGraw Hill Education Private Limited, New Delhi, 2007.
3. Mahadevan, B., Operations Management, Theory and Practice, second edition, Pearson Education, 2010.

References

1. S N chary, Production and Operations Management, Tata McGraw-Hill
2. R Panneerselvam, Production and Operations Management, PHI Learning pvt Ltd
3. Norman Gaither, Greg Frazier, Operations management, South Western, CNGAGE Leaning
4. Lee Krajewsky etal., Operations Management, Processes and Value chains, Prentice Hall of India

Course outcomes::

1. Accept and successfully fulfill leadership responsibilities when required by the company
2. Conduct an objective assessment of the change in various manufacturing related metrics and accordingly manage the operations
3. Coordinate with product development teams to achieve design for manufacturability

4. Demonstrate initiative and originality in solving industrial technology management problems and act autonomously in planning and managing
5. Apply sustainable manufacturing methods to obtain acceptable products

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	1							3					
2	1							3			1		
3	1							3			1		
4	1							3			1		
5	1							3			1		

1-Low, 2- Medium and 3- High Correlation

20EME832: ARTIFICIAL INTELLEGENCE AND MACHINE LEARNING

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Description:

There exists extensive thrust in the industry to develop and build new solutions in business and industrial environments using AI and ML techniques. Hence this course aims to develop the skills of students in alignment with industrial needs. It deals with the fundamentals and intricate concepts of artificial intelligence and machine learning. It equips students with the knowledge to build algorithms necessary and work with various data sources. It is designed to develop innate skills such as automatic programming techniques, case driven reasoning, neural networks, fuzzy logic, decision making, and expert systems etcetera.

Course Objectives

- To comprehend the classical and symbolic approach to Artificial Intelligence
- To understand the principles of the main paradigms for learning from data and their applications.
- The explore Machine Learning techniques for building new adaptive systems
- To learn and analyze predictive models for intelligent data analysis.

Unit-I **10 hrs**

Introduction: Definition of Artificial Intelligence, Evolution, Need, and applications in real world. Intelligent Agents, Agents and environments; Good Behavior-The concept of rationality, the nature of environments, the structure of agents.

Neural Networks and Genetic Algorithms: Neural network representation, problems, perceptrons, multilayer networks and back propagation algorithms, Genetic algorithms, hypothesis space search

Learning outcomes:

At the end of this unit, the student will be able to

- **interpret** the fundamentalsofAI **[L2]**
- **explain** the concepts of neural networks and genetic algorithms **[L2]**
- **solve** problems pertaining to AI algorithms**[L3]**

Unit-II **10 hrs**

Knowledge – Representation and Reasoning: Logical Agents: Knowledge based agents, the wumpus world, logic. Patterns in Propositional Logic, Inference in First-Order Logic-Propositional vs first order inference, unification and lifting

Learning outcomes:

At the end of this unit, the student will be able to

- **interpret** the mechanisms of handling knowledge base **[L2]**
- **compare** techniques of logic management in AI**[L2]**

Unit-III **8 hrs**

Bayesian and Computational Learning: Bayes theorem , concept learning, maximum likelihood, minimum description length principle, Gibbs Algorithm, Naïve Bayes Classifier, Instance Based Learning- K-Nearest neighbour learning

Introduction to Machine Learning (ML) : Definition, Evolution, Need, applications of ML in industry and real world, classification; differences between supervised and unsupervised learning paradigms.

Learning outcomes:

At the end of this unit, the student will be able to

- **classify** and illustrate different types algorithms **[L2]**
- **explain** the concept of machine learning and its applications to different real world. **[L2]**

Unit-IV **8 hrs**

Basic Methods in Supervised Learning: Distance-based methods, Nearest-Neighbors, Decision Trees, Support Vector Machines, Nonlinearity and Kernel Methods,

Unsupervised Learning: Clustering: K-means, Dimensionality Reduction: PCA and kernel PCA, Generative Models (Gaussian Mixture Models and Hidden Markov Models)

Learning outcomes:

At the end of this unit, the student will be able to

- **interpret** the working of different supervised learning algorithms and assess their suitability to a given problem **[L1]**.

- **demonstrate** the working of different dimensionality reduction techniques on high dimensional datasets **[L3]**
- **illustrate** the working of Generative Models mathematically. **[L3]**

Unit-V **9 hrs**

Machine Learning Algorithm Analytics : Evaluating Machine Learning algorithms, Model Selection, Ensemble Methods (Boosting, Bagging, Random Forests)

Modeling Sequence/Time-Series Data and Deep Learning: Deep generative models, Deep Boltzmann Machines, Deep auto-encoders, Applications of Deep Networks.

Learning outcomes:

At the end of this unit, the student will be able to:

- **interpret** ensemble models as a function of different weak classifiers. **[L3]**
- **compare** the performances of different classification models. [**L4]**
- **understand** the methods for handling time series and sequence data. **[L2]**
- **demonstrate** the working of different deep learning approaches. [**L3]**

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
2. Tom M. Mitchell, Machine Learning, McGraw Hill , 2013. 2. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press, 2004

References:

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI Learning, 2012..
3. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, 1/e, Springer, 2001.
4. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
5. M Narasimha Murty, Introduction to Pattern Recognition and Machine Learning, World Scientific Publishing Company, 2015

Course Outcomes:

After the completion of the course, the students will be to:

1. **interpret** the meaning, purpose, and applications of AI **[L1]**
2. **differentiate** supervised and unsupervised learning models and techniques. **[L3]**
3. **relate** knowledge about application of machine learning techniques to real world problems. **[L3]**
4. **assess** different machine learning algorithms based on performance evaluation measures. **[L5]**
5. **analyze** the importance of AI and ML in industry **[L3]**

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1							3					3	
2							3					3	
3							3					3	
4							3					3	
5							3					3	

1-Low, 2- Medium and 3- High Correlation

20EME834: MICRO MACHINING PROCESSES

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Description:

Nowadays, focus is on miniaturization through development of novel production concepts (especially micro & nano) for the processing of non-ceramic materials.Microfabrication deals with all kind of manufacturing processes but at micro & nano level.The replication of micro parts through molding is one of the preferred routes for micro manufacture because of its mass-production capability and relatively low cost.However in this course will mainly concentrate on micro attritious processes: "Micro Machining Processes"

Course Objectives

To analyze and determine material fabrication processes.

- Study of various micro machining processes.
- Application of these machining methods in various fields.
- Enhance his knowledge in semiconductor manufacturing processes.

Unit I **10 hours**

Micromachining – definition, historical background, Need and applications of micromachining in engineering industries. Principle of mechanical micromachining - Classification of micromachining and nano finishing processes. Size comparisons in micro manufacturing and micro products. Problems in micro machining.

Learning outcomes

At the end of this Unit, the student will be able to

- Understand history, concepts and terminology of micro machining processes (L1).
- Differentiate between micro and traditional machining processes (L4).

Unit II **10 hours**

Mechanical Advanced Micromachining And Nano-finishing Processes: Abrasive Jet Micromachining (AJMM), Ultrasonic Micromachining (USMM), Abrasive Water Jet Micro Machining (AWJMM), Abrasive Flow nano finishing (AFNF). Principle of working and applications.

Learning outcomes

At the end of this Unit, the student will be able to

- Ability to fabricate semiconductor devices using micro machining techniques (L3).
- Articulate the various tradeoffs that must be made in selecting micro machining processes, devices and materials to suit particular product requirements (L4).

Unit III **10 hours**

Thermoelectric Advanced Micromachining Processes: Electric Discharge Micromachining (EDMM), Wire Electric Discharge Micromachining (WEDMM), Laser Beam Micromachining (LBMM), Electron Beam Micromachining (EBMM). Principle of thermal advanced micromachining processes and applications.

Learning outcomes

At the end of this Unit, the student will be able to

- Identify the need for thermoelectric based micromachining processes (L3).
- Demonstrate the application of thermoelectric micromachining processes (L2).

Unit IV **10 hours**

Electrochemical and Chemical Micromachining Processes: Electrochemical Micromachining (ECMM), Electrochemical Micro Grinding (ECMG), Electro stream Micro drilling (ESMD), Electrochemical Micro deburring (ECMDe), Chemical Micromachining (ChMM). Principle of thermal advanced micromachining processes and applications.

Learning outcomes

At the end of this Unit, the student will be able to

- Design and develop newer tooling models (L3).
- Select suitable machining process for suitable materials (L4).

Unit V **8 hours**

Advanced nano finishing processes: Elastic Emission Machining (EEM) and Ion Beam Machining (IBM). **Integrated-circuits based microfabrication technology:** Surface micromachining and Bulk micromachining. Principle of thermal advanced micromachining processes and applications.

Learning outcomes

At the end of this Unit, the student will be able to

- Evaluate the usage of advanced nano finishing processes for surface coatings (L5).
- Analyze the cases relevant to bulk micromachining and some of the important research challenges associated with microfabrication technologies (L4).

Text Book(s)

1. Jain V. K., Introduction to Micromachining, 2nd edition, Narosa Publishers, New Delhi (2014)
2. Jackson M. J., Micro and Nanomanufacturing, CRC Press, Taylor and Francis (2006).

3. Ghosh, A. and Mullick, S., Manufacturing Science, New Age International (2001).
4. Pandey, P.C. and Shan H.S., Modern Machining Processes, McGraw Hill (2004).

References

1. Micromachining of Engineering Materials J.A. McGeough. CRC Press
2. Hofy, H.E., Advanced Manufacturing Process, B and H Publication (1998)
3. Mishra, P.K., Non Conventional Machining, Narosa (2006).

Course Outcomes

After completing the course, the student will be able to

1.understand the importance and principles of various micromachining processes.
2.select proper micro machining processes for various applications.
3.analyze the processes and evaluate the role of process parameters during micro machining of various materials.
4.identify the requirements to achieve best quality of machined surface while micro machining of various industrial engineering materials.
5.understand the importance of micro fabrication technology and its applications.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	3	1									2	1	
2	3	1									3	1	
3	3	2									3	2	
4	3	1									3	1	
5	2										2		

1-Low, 2- Medium and 3- High Correlation

20EME836: IOT/IT IN MANUFACTURING

L	T	P	C
3	0	0	3

Course Description:

This course exposes the students on diversity of Digital -controlled manufacturing processes and information systems developments. Use of information technology in manufacturing applications in the organizations.

Course Objectives

- To understand the concepts of Digital manufacturing system.
- To study the importance of organization and management information systems
- To understand the concepts of **Information Technology Infrastructure**
- To understand the techniques of product life cycle management.
- To Illustrate the application of digital manufacturing using information technology

Unit-I **10hours**

Manufacturing organizations, management, and the networked enterprises, Globalization challenges and opportunities, Dimensions of Information systems, Approaches to study information system, Technical and Behavioral approach.**Introduction to Digital Manufacturing**: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System. manufacturing systems.

Learning outcomes:

At the end of this unit, the student will be able to

- understand the manufacturing information systems **[L1]**
- comprehend the concept of digital manufacturing **[L2]**

Unit-II **10hours**

Organizations, management, and the networked enterprise: Information systems in global business today, Global e-business: Use of information systems in manufacturing functions, information system, organizations, and strategy, ethical and social issue in information systems

Learning outcomes:

At the end of this unit, the student will be able to

- understand the organizational information system**[L1]**
- understand the e-business concepts using information system **[L1]**

Unit-III **10hours**

Information Technology Infrastructure: IT Infrastructure and Emerging Technologies, Foundations of Business Intelligence: Databases and Information Management, Telecommunications, the Internet, and Wireless Technology, Securing Information Systems, Shop floor communications.

Learning outcomes:

At the end of this unit, the student will be able to

- comprehend the concept of Information technology infrastructure **[L2]**

- understand the IT Infrastructure and Emerging Technologies **[L1]**

Unit-IV **8hours**

PRODUCT LIFE CYCLE MANAGEMENT: Introduction, Types of Product Data, PLM systems, Features of PLM System, System architecture, Product information models, Functionality of the PLM Systems.

Learning outcomes:

At the end of this unit, the student will be able to

- Understand the concepts of Product life cycle **[L1]**
- analyze the functionality of the PLM Systems. **[L4]**

Unit-V **7hours**

Key System Applications: Achieving Operational Excellence and Customer Intimacy: Enterprise Applications, E - Commerce: Digital Markets, Digital Goods, Managing Knowledge and Collaboration, Enhancing Decision Making.

Learning outcomes:

At the end of this unit, the student will be able to

- identify different areas of Digital and Smart Manufacturing and its applications **[L4]**

Text Books:

1. K. Laudon and J. Laudon, Management Information Systems, 14th edition, Pearson Higher Education, 2016, ISBN: 9780136093688.
2. F. Cecelja, Manufacturing Information and Data Systems, 1st edition, Butterworth - Heinemann, 2002, ISBN: 97 81857180312.

References

1. T. O. Boucher and A. Yalçin, Design of Industrial Information Systems, 1st edition, Elsevier, 2006, ISBN: 9780123704924.
2. K. E. Kurbel, Enterprise Resource Planning and Supply Chain Management: Functions, Business Processes and Software for Manufacturing Companies, 1st edition, Springer, 2013, ISBN: 9783662509869.
3. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", Springer, 2004.
4. M. P. Groover, Automation, Production systems and Computer Integrated Manufacturing. 3rd edition, Pearson Education, 2015. ISBN: 978-9332549814.
5. Scrope Kalpakjian,, "Manufacturing processes for Engineering Materials", Addision Wesley, 1997.
6. M. Kuniavsky, Smart Things: Ubiquitous Computing User Experience Design, 1st edition, Morgan Kaufmann, 2010, ISBN-10: 0123748992

Course Outcomes:

At the completion of the course, the students should able to

1. understand the concepts of Digital manufacturing information system **[L1].**
2. understand the information systems in manufacturing functions **[L1]**.
3. apply knowledge on IT Infrastructure and Emerging Technologies **[L3].**.
4. analyze the functionality of the PLM Systems**[L4].**

5. Understand the application of Digital and Smart Manufacturing **[L1].**

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	1						3					2	
2	1						3					2	
3	1						3					2	
4	1						3					2	
5	1						3					2	

1-Low, 2- Medium and 3- High Correlation

20EME838: RELIABILITY AND FAILURE ANALYSIS

L	**T**	**P**	**C**
3	**0**	**0**	**3**

Course Description:

The objective is to introduce the fundamentals of reliability analysis in planning and design the components/systems.also, describesthe possible use of failure analysis techniques as means to produce/develop more reliable systems. Emphasizes on failure analysis techniques can be profitably applied during the analysis stage to identify potential hazards in requirements and design.

Course Objectives

- To explain various concepts of probability theory
- To discuss reliability evaluation of a system.
- To demonstrate time dependent reliability concepts.
- To illustrate cumulative repairable models.
- To analyze different failure analysis techniques.

Unit-I **10hours**

Basic Probability Theory Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples.

Learning outcomes:

At the end of this unit, the student will be able to

6. Define the significance of probability concept **[L1]**
7. Analyze different binomial distribution**[L4]**

Unit-II **10hours**

Network Modeling and Reliability Evaluation Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cutset based approach – complete event tree and reduced event tree methods - Examples.

Learning outcomes:

At the end of this unit, the student will be able to

8. Examine reliability of series and parallel systems **[L4]**
9. Make use of conditional probability method to evaluate reliability **[L3]**

Unit-III **10hours**

Time Dependent Probability Basic concepts – Reliability functions f(t), F(t), R(t), h(t) – Relationship between these functions – Baths tub curve – Exponential failure density and distribution functions - Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel, Series-Parallel systems - Partially redundant systems - Evaluation of reliability measure – MTTF for series and parallel systems – Examples.

Learning outcomes:

At the end of this unit, the student will be able to

10. Categorize MTTF,MTBF AND MTTR **[L4]**
11. Maximize the availability of system **[L6]**

Unit-IV **8hours**

Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and 'n' component repairable model - Series systems, Parallel systems, Basic reliability indices – Cutset approach – Examples

Learning outcomes:

At the end of this unit, the student will be able to

12. Measure cumulative reliability and cumulative frequency of systems **[L5]**
13. Formulate recursive relation to evaluate transition rates of systems**[L6]**

Unit-V **10hours**

Failure Mode and Effect Analysis (FMEA) ,why-why analysis, Maintainability-Concepts-tasks-modeling and allocation-prediction-FMECA-reliability and maintainability trade off-Design for maintainabilitydesign methods, Reliability Centered Maintenance-goals and principles-components-predictive testing and Inspection techniques-effective measurement indicators-Advantages,General Procedure of the FTA- Qualitative Fault Tree Analysis- Quantitative Fault Tree Analysis,Reliability Graph- Examples, FRACAS.

Learning outcomes:

At the end of this unit, the student will be able to

14. Classify failure analysis techniques **[L4]**
15. Apply Failure analysis techniques to evaluate failures of the system **[L3]**

Text Books:

1. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.

2. Reliability and Maintainability Engineering by Charles E. Ebeling, Tata McGraw Hill, 2000

References

1. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015
2. Probability concepts in Electric Power system by G.J.Anders, 1st edition, John wiley & sons,1990

Course Outcomes:

At the completion of the course, the students should able to

1. Define the probability of failure of a system[L1]
2. Identify the reliability of series and parallel systems[L3]
3. Evaluate Mean Time Between Failure of a system[L5]
4. Discover failures with the use of failure analysis methods[L4]
5. Categorize the Failures of a system[L4]

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		3										2	
2		3										2	
3		3										2	
4		3										2	
5		3										2	

1-Low, 2- Medium and 3- High Correlation

20EME932: TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Course Description:

Through this subject, students will understand how an organisation would succeed in long-term through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work. TQM principles and tools help in aligning organization's objectives with customer needs. Quality systems and auditing will ensure TQM implementation.

Course objectives

- To give an overview of quality and TQM and explaining the salient contributions of Quality Gurus like Deming, Juran and Crosby. General barriers in implementing TQM.
- To study the TQM concepts like customer Focus, Employee Focus and their involvement, continous process improvement and Supplier Management.

- To learn the basic and new seven management tools, Quality concepts like Six sigma, Failure mode effect analysis.
- To explore industrial applications of Quality function deployment, taguchi quality concepts and TPM.
- Detailed exposure to students on various quality systems like ISO and its standards.

Unit-I Introduction **9 hours**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements – Customerfocus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Cost of Quality

Learning outcome:

At the end of this unit, the student will be able to

- Understand quality management philosophies and frameworks**[L1]**
- Outline various tools and techniques of quality management **[L2]**

Unit-II TQM PRINCIPLES **9 hours**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

Learning outcome:

At the end of this unit, the student will be able to

- Apply quality management philosophies and frameworks**[L3]**
- Illustrate the applications of quality tools and techniques in both manufacturing and service industry **[L3]**

Unit-III TQM TOOLS & TECHNIQUES - I **9 hours**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Benchmarking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

Learning Outcome:

At the end of this unit, the student will be able to

- Analyse quality management issues in the industry**[L4]**
- Resolve those issues and suggest implementable solutions **[L3]**

Unit-II TQM TOOLS & TECHNIQUES - II **9 hours**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

Learning outcome:

At the end of this unit, the student will be able to

- Understand the concepts of SIx Sigma**[L1]**

- Design Taguchi quality loss function to improve performance measures**[L6]**

Unit-V QUALITY SYSTEMS **9 hours**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

Learning outcome:

At the end of this unit, the student will be able to

- Evaluate different ISO auditing systems**[L5]**
- Formulate TQM solutions in manufacturing and service sectors **[L6]**

Text Book(s):

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

References:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012. www.padeepz.net www.padeepz.net
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

Course outcomes

At the completion of the course, the students should able to

1. develop an understanding on quality management philosophies and frameworks
2. develop in-depth knowledge on various tools and techniques of quality management.
3. learn the applications of quality tools and techniques in both manufacturing and service industry
4. develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implementable solutions to those.
5. design Quality frameworks

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1										3		2	
2										3		2	
3										3		2	
4										3		2	
5										3		2	

1-Low, 2- Medium and 3- High Correlation

20EME934: DESIGN OF EXPERIMENTS

L	T	P	C
3	0	0	3

Course Description:

This course will help the learners that, how to use experiments to gain maximum knowledge at minimum cost. For processes of any kind that have measurable inputs and outputs, Design of Experiments (DOE) methods guide the optimum selection of inputs for experiments, and in the analysis of results. Full factorials as well as fractional factorial designs are covered for the design of experiments.

Course objectives:

- Understand the different philosophical approaches to experimental design.
- Build a solid foundation for the statistical theory for experimental design.
- Develop appropriate statistical models for designed experiments, perform data analysis using appropriate software, and communicate results without use of statistical jargon.
- Construct appropriate experimental designs for given problems: sample size determination, choice of levels of variables, designs with restrictions on randomization, utility functions for measuring design objectives, use of simulation to characterize properties of designs.
- Able to perform the proper statistical analysis and draw valid conclusions from a specific experiment.

Unit-I **10 hours**

Fundamentals of Experimentation: Role of experimentation in rapid scientific progress, Historical perspective of experimental approaches, Steps in experimentation, Principles of experimentation.

Learning outcomes:

At the end of this unit, the student will be able to

- Recognize the role of experimentation. **[L1]**
- Illustrate the principles of experimentation. **[L2]**

Unit-II **8 hours**

Simple Comparative Experiments: Basic concepts of probability and statistics, Comparison of two means and two variances, Comparison of multiple (more than two) means & ANOVA.

Learning outcomes:

At the end of this unit, the student will be able to

- Practice the basic concepts of probability and statistics. **[L3]**
- Compare the means and variances. **[L2]**

Unit-III **10 hours**

Experimental Designs: Factorial designs, fractional factorial designs, orthogonal arrays, standard orthogonal arrays & interaction tables, modifying the orthogonal arrays, selection of suitable orthogonal array design, analysis of experimental data.

Learning outcomes:

At the end of this unit, the student will be able to

- Design the experiments using factorial designs and orthogonal arrays. **[L6]**
- Analyze the data for experiments conducted. **[L4]**

Unit-IV **8 hours**

Response Surface Methodology: Concept, linear model, steepest ascent, second order model, regression.

Learning outcomes:

At the end of this unit, the student will be able to

- Develop the models for the experimental data using RSM techniques. **[L6]**
- Interpret the results of experimental data by using regression analysis. **[L3]**

Unit-V **9 hours**

Taguchi's Parameter Design: Concept of robustness, noise factors, objective function & S/N ratios, inner-array and outer-array design, data analysis.

Learning outcomes:

At the end of this unit, the student will be able to

- Recommend the Taguchi's Parameter Design approach for data analysis.**[L5]**
- Explain the concepts of robustness and array design.**[L3]**

Text Book(s):

1. Montgomery DC, Design and Analysis of Experiments, 7th Edition, John Wiley & Sons, NY, 2008.
2. Ross PJ, Taguchi Techniques for Quality Engineering, McGraw-Hill Book Company, NY, 2008.

References:

1. Alberto Garcia-Diaz and D.T. Phillips, Principles of Experimental Design and Analysis, Chapman & Hall, New York, 1995.
2. Box, Hunter and Hunter, Statistics for Experimenters, John Wiley & Sons.
3. C.R. Hicks, Fundamental Concepts in the Design of Experiments, Holt, Rinehart and Winston, Inc.
4. O.L. Davies, Design and Analysis of Industrial Experiments, Hafner Publishing Company.

Course outcomes:

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

1. Formulate objective(s) and identify key factors in designing experiments for a given problem.
2. Develop appropriate experimental design to conduct experiments for a given problem.
3. Analyze experimental data to derive valid conclusions.
4. Optimize process conditions by developing empirical models using experimental data.
5. Design robust products and processes using parameter design approach.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		3										3	
2		3										3	
3		3										3	
4		3										3	
5		3										3	

1-Low, 2- Medium and 3- High Correlation

20EME936: COMPUTER INTEGRATED AND MANUFACTURING

L T P C
3 0 0 3

Course Description:

This course provides basic knowledge about computer integrated manufacturing and it deals with grouping technology which is one of the most important technology followed in leading industries. It provides the basic knowledge of Computer aided process planning, Artificial Intelligence, Integrative Manufacturing Planning and Control. CIM combines various technologies like computer-aided design (CAD) and computer-aided manufacturing (CAM) to provide an error-free manufacturing process that reduces manual labour and automates repetitive tasks.

Course objectives

- To introduce the concepts of automation, group technology integrated to Computer aided design and manufacturing.
- To obtain an overview on computer aided process planning and artificial intelligence process planning.
- To impart the knowledge of forecasting, scheduling capacity planning, shop-floor control in manufacturing systems and the concept of JIT manufacturing.
- To impart the basic knowledge of quality control, inspection methods and computer-aided testing.
- To classify and summarise the manufacturing systems, and integration of CAQC with CAD/CAM.

Unit- I **9 hours**

Introduction: Scope of computer integrated manufacturing, product life cycle, production automation. Group technology: Role of group technology in CAD/CAM integration, methods for developing part families, parts classification and coding, examples of coding systems, Implementation of group technology, facility design using group technology, economics of group technology, Machine group/Cell.

Learning Outcomes:

- Identify the importance and scope of CIM in fabrication/ manufacturing industry. [L1]
- Describe automated production and assembly lines. [L2]

- Identify the stages of the product life cycle and related challenges. [L2]
- To enumerate the importance of group technology. [L1]
- Applying the types of coding system to different part designs. [L3]

Unit-II **9 hours**

Computer Aided Process Planning: Approaches to process planning, manual, variant, generative approach, implementation techniques, process planning systems – CAM-I'S CAPP system, MIPLAN system, CMPP, criteria for selecting a CAPP system, part feature recognition, approaches to part feature recognition, artificial intelligence in Process Planning.

Learning Outcomes of Module-II:

- Examine automated storage/retrieval system. [L1]
- Discuss the computer aided process planning. [L2]
- Illustrate the knowledge of different forms of learning. [L3]
- Explain the concept of part feature recognition. [L2]
- Establish artificial intelligence in process planning. [L3]

Unit-III **9 hours**

Integrative Manufacturing Planning and Control: Role of integrative manufacturing in CAD/CAM integration, production control function, business planning, forecasting and its techniques, master production schedule, capacity planning, Material Requirement Planning, order release, shop-floor control system, scheduling techniques, cellular manufacturing, JIT manufacturing philosophy, elements of JIT, Pull and Push system, Kanban.

Learning Outcomes of Module-III:

- Application of industrial engineering theory and practice to the area of operations management and production planning/control. [L3]
- Interpret forecasting, aggregate planning, capacity planning, materials requirement planning, short-term scheduling and sequencing. [L2]
- practice to use and compare various forecasting models [L3]
- observe just-in-time systems. [L1]

Unit-IV **9 hours**

Computer Aided Quality Control: Terminology in quality control, Inspection and testing, automated inspection principles and methods, contact inspection methods, noncontact inspection methods, and computer aided testing, integration of CAQC with CAD/CAM.

Learning Outcomes of Module-IV:

- identify automated inspection system. [L2]
- Apply the knowledge of inspection techniques. [L3]
- illustrate the concept of integration of CAQC with CAD/CAM. [L2]
- Apply knowledge about computer aided quality control and process planning. [L3]

Unit-V **9 hours**

Computer Integrated Manufacturing Systems: Types of manufacturing systems, machine tools and related equipment, material handling systems, AGV's, Elements of FMS, Classification system for FMS and Types of FMS, Computer Control Systems.

Learning Outcomes of Module-V:

- explain flexible manufacturing system. [L2]
- observe automated material handling system. [L2]
- discuss processing stations and material handling systems used in FMS environments. [L2]
- apply FMS concept in a manufacturing environment [L3]
- Identify the various elements and their activities in the Computer Integrated Manufacturing Systems. [L1]

Text books:

1. Mikell P. Groover, Automation, Production Systems, and Computer Aided Manufacturing, 2/e., Prentice Hall, 2001.
2. Dr.Sadhu Singh, Computer Aided Design and Manufacturing, Khanna publishers,2011.
2. Mikell P. Groover, and Zimmers, CAD/CAM: Principles and Applications, 3/e, Tata-McGraw hill, 2010.

References:

1. M.M.M. Sarcar, K. Mallikarjuna Rao, K. Lalit Narayan, Computer Aided Design and Manufacturing, 2/e, Prentice Hall of India, 2008.

Course outcomes:

1. To understand the concepts of Production Automation, Process Planning & Quality control in Computer Integrated Manufacturing Systems.
2. To analyze the Computer Aided Process Planning &Control, Material handling, and Artificial intelligence in FMS.
3. To acquire the knowledge on quality control; computer aided testing and inspection methods.
4. To design and solve the problems of Forecasting, Scheduling, and capacity planning in manufacturing and assembling.
5. To integrate computer aided design and computer aided manufacturing protocols to manufacture products.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		3						1		1		2	
2		3						1		1		2	
3		3						1		1		2	

4		3						1		1		2	
5		3						1		1		2	

1-Low, 2- Medium and 3- High Correlation

20EME938: INVENTORY CONTROL

L	T	P	C
3	0	0	3

Course Description:

This course explores the concept of inventory control, models of dependent and independent demand and classical reorder point. It also covers ware house and its operations. Recent developments in ICT and RFID technologies can be learnt and these techniques can be implemented to real life problems. Finally, the course also deals with health and safety assessment risks.

Course objectives:

- To understand role and importance of inventory management in an industry.
- To familiarise the basic concepts of forecasting techniques.
- To enhance analytical skills and ability to solve real life inventory management problems using ICT.
- To develop inventory system suitable for the organisation
- Adapting the health and safety measures at warehouse

Unit-I **9 hours**

Inventory Control: Introduction, functions of inventory, types of inventory, economic order quantity. Inventory Models: deterministic models – EOQ model, production model – with shortages and without shortages, quantity discount model. ABC Analysis: Mechanics of ABC analysis, purpose of ABC analysis, advantages and disadvantages, simple problems, VED analysis.

Learning outcomes:

At the end of this unit the student is able to

- Recognize the functions of inventory [L1]
- Evaluate economic order quantity [L2]
- Analyze components into groups according to ABC and VED analysis.

Unit-II **9 hours**

Quantities of Manufacture or Purchase: Lot size problems, finite production rates in manufacturing, quantity discounts. Uncertainty: Effects of uncertainty, demand and supply, safety stock, role of forecasting in production and inventory control. Uncertainty in production cycling.

At the end of this unit the student is able to

- Take decisions regarding make or buy of a product. [L1]
- Calculate the production rates in manufacturing of the products. [L2]
- Debate the effects of uncertainty in demand and supply of a product. [L5]

Unit-III **9 hours**

Warehouse and its Operations: Introduction, Objectives, Warehouse Structure, Warehouse Operations, receiving inventory, picking inventory, locating inventory, Organising inventory, Despatching inventory, Equipment Used for a Warehouse.
At the end of this unit the student is able to

- Describe the objectives of the ware house[L1]
- Classify the equipment used in a warehouse[L2]
- Design a warehouse[L6]

Unit-III **9 hours**

ICT Applications in a Warehouse Management: Introduction, Objectives, Bar Code Scanners, Wireless LAN, Mobile Computers, Radio Frequency Identification (RFID).
At the end of this unit the student is able to

- Summarize the usage of ICT applications in the warehouse. [L2]
- Interpret technology aids in warehouse management. [L2]
- Design a RFID. [L6]

Unit-V **9 hours**

Health and Safety Perspective: Introduction, Objectives, Health and Safety at Work, Health and Safety Risks at the Warehouse, Assessment of Risks, Management of Health and Safety.
At the end of this unit the student is able to

- List the applications of safety precautions maintaining the inventory. [L1]
- Identify the need for safety in inventory. [L2]
- Assess the risk involved in the storage of inventory. [L5]

Text Book:

1. Walters, D. "Inventory Control and Management". 2nd ed. John Wiley & Sons Ltd.
2. Mulcahy, D.E. "Warehouse Distribution & Operations Handbook. McGraw-Hill.

References:

1. Sridhara Bhatt, Logistics and Supply Chain Management, Himalaya Publishers, 2011
2. D.K Agarwal, Logistics and supply chain Management, Macmillan Publishers, 2013.

Course outcomes:

At the completion of the course the student is able to

1. Understand the role and importance of inventory management in an industry.
2. Become familiar with the basic concepts of forecasting techniques.
3. Acquire the analytical skills and ability to solve real life inventory management problems using ICT.
4. To develop inventory system suitable for the organization
5. Adapt the health and safety measures at warehouse

CO-PO MAPPING

	POs	**PSOs**

CO	1	2	3	4	5	6	7	8	9	10	1	2	3
1		1								3		1	
2		1								3		1	
3		1								3		1	
4		1								3		1	
5		1								3		1	

1-Low, 2- Medium and 3- High Correlation

20EMC741: RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Course Description:

This course introduces the student, to the fundamentals of research, research process, technical writing and intellectual property rights. Students will be able to use this knowledge to gain interest in their subject area and pursue their career in research.

Course Objectives

- To familiarize the meaning, objectives and sources of research
- To acquaint the student with the importance and methods of literature review/research ethics
- To impart the knowledge of technical writing for preparing reports, presentations, research proposals, conference/journal publications
- To introduce the terminology and process of obtaining intellectual property rights
- To expose the intricacies in the process of obtaining patent rights

Unit I **5 hours**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning of a research problem
- list the different sources of research problem
- enumerate the different criteria of good research and list the different errors in selecting research problem
- compare the different methods for data collection and analysis

Unit II **5 hours**

Effective literature studies approaches, analysis Plagiarism, Research ethics

Learning Outcomes

After the completion of this unit, the student will be able to

- list and elaborate the different steps of the research process
- identify the research gaps from literature review
- describe the ethical principles to be following during research process and authorship
- define the terminology and list the methods to avoid being accused of plagiarism
- list the different types of research misconduct

Unit III **5 hours**

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Learning Outcomes

After the completion of this unit, the student will be able to

- list the attributes, reasons and guidelines for effective technical writing
- contrast between conference paper, technical presentation and journal paper
- choose a particular research contribution for patenting or journal publication
- define the terminology related to citation, citation index, h-index etc

Unit IV **5 hours**

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. **International Scenario**: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the codes and standards in building intellectual property rights
- list the subject, importance and requirements for of patentability
- explain the process of patenting and commercialization in academia
- enumerate the procedure for application preparation, filing and grant of Patents
- define the terminology related to citation, citation index, h-index etc.

Unit V **8 hours**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the scope of patent rights
- describe the process for licensing and transfer of technology
- identify the sources of patent information and databases
- elaborate the administration of patent system
- describe the new developments in IPR in computer software, biological systems etc

Text Book(s):

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for Science and engineering students”, Tata Mcgraw Hill India, 2013.
2. Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners”, 2/e, Prentice Hall of India, 2013.

References:

1. Halbert, “Resisting Intellectual Property”, Taylor and Francis Limited, 2007.
2. Mayall, “Industrial Design”, McGraw Hill, 1992.
3. Niebel, “Product Design”, McGraw Hill, 1974.
4. Asimov, “Introduction to Design”, Prentice Hall, 1962.

5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016
6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand Publishers, 2008.

Course Outcomes:

After successful completion of the course, the student will be able to

1. define the meaning, sources, approaches for research problems
2. explain the guidelines for carrying out effective literature review and identify research gaps
3. describe effective guidelines for preparing technical reports, research publications, presentations and research proposals.
4. describe the codes, standards and process of obtaining intellectual property rights
5. enumerate the new developments of IPR in engineering systems

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								2	2				
2								2	2				
3								2	2				
4								2	2				
5								2	2				

1-Low, 2- Medium and 3- High Correlation

20EOE742: BUSINESS ANALYTICS

L	T	P	C
3	0	0	3

Course Description:

This course introduces students to the science of business analytics. The goal is to provide students with the foundation needed to apply data analytics to real-world challenges they confront daily in their professional lives. Students will learn to identify the ideal analytic tool for their specific needs; understand valid and reliable ways to collect, analyze, and visualize data; and utilize data in decision making for managing agencies, organizations or clients in their workspace

Course Objectives

- To familiarize the scope, process and advantages of business analytics
- To acquaint the student with the modeling and problem solving skills in business analytics
- To impart the organization and management of business analytics
- To introduce the forecasting models and techniques used in analytics
- To expose the formulation and decision strategies used in business analytics

Unit I **8L**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview

Learning Outcomes

After the completion of this unit, the student will be able to

- define the scope and process of business analytics (L1)
- choose an organizational structure to implement a business analytics process (L3)
- describe the statistical tools and methods used for data modeling and analysis (L2)
- identify the sampling and estimation requirements for data analysis (L1)

Unit II **8L**

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Learning Outcomes

After the completion of this unit, the student will be able to

- identify the relationships and trends in data (L1)
- utilize linear regression methods for identifying data relationships (L4)
- list the types of data and their models used for business analytics (L1)
- describe the methods for visualization and exploration of data (L2)

Unit III **8L**

Organization Structures of Business analytics: Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the management issues in the organization structures (L2)
- define the designing information policy and its usage (L1)
- list the methods for ensuring data quality measuring contribution (L1)
- explain the use of data mining methodologies for predictive analytics analysis (L3)
- describe the use of prescriptive analytics methods in business analytics process (L2)

Unit IV **10L**

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Learning Outcomes

After the completion of this unit, the student will be able to

- classify and describe the use of forecasting models (L3)
- model the use of regression forecasting with casual variables (L5)
- identify the appropriate forecasting model for a given data (L5)
- explain the use of Monte Carlo simulation for forecasting and identify the involved risk (L2)

Unit V **8L**

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Learning Outcomes

After the completion of this unit, the student will be able to

- formulate decision problems (L2)
- list the decision strategies with and without probabilities (L1)
- use the decision trees for analysis (L4)
- describe the value of information, utility and its use in decision making (L4)

Textbook(s):

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications Pearson FT Press, 2014.
2. James Evans, Business Analytics, Pearson Education, 2013.

Course Outcomes:

Upon successful completion of the course, the student will be able to

- define the scope, process and advantages of business analytics (L1)
- explain the modeling and problem solving skills in business analytics (L2)
- describe the organization and management of business analytics (L3)
- utilize the forecasting models and techniques used in analytics (L4)
- enumerate and utilize the formulation and decision strategies (L2)

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		1						3				1	

2		1						3				1	
3		1						3				1	
4		1						3				1	
5		1						3				1	

1-Low, 2- Medium and 3- High Correlation

20EOE744: INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

Course Description:

Safety by design or prevention through design is in the core for maintaining engineering systems safe. The students will be equipped with concepts of engineering systems safety, dimensions of engineering systems safety, safety design and analysis mathematics, design for engineering systems safety and control for safety, and integrating safety with other operational goals such as quality and reliability

Course Objectives

- to impart knowledge on different facets and aspects of industrial systems safety
- to familiarize the student with tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings
- to impart the knowledge of definition, function and types of maintenance activities
- to familiarize the different wear and corrosion mechanisms and their prevention methods
- to expose the students to different faults and their tracing mechanisms
- to impart the art of planning periodic and preventive maintenance mechanisms

Unit I **8L**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc., Safety color codes. Fire prevention and firefighting, equipment and methods.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the different types of mechanical and electrical hazards in industrial systems(L1)
- enumerate the salient points of factories act 1948(L2)
- describe the health and safety measures to be enforced for industrial safety(L3)
- elaborate the different fire prevention and firefighting arrangements to be made(L2)

Unit II **8L**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning and aim of maintenance engineering(L1)
- elaborate the primary and secondary functions of maintenance department(L2)
- classify the different types and applications of maintenance(L3)
- relate the replacement economy with maintenance cost(L5)
- estimate the service life of equipment from the specifications of individual components(L4)

Unit III **8L**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the different types, causes and effects of Wear(L2)
- elaborate the different methods for reducing wear(L2)
- list the different types of lubricants and mention their applications(L1)
- define the principle and factors affecting corrosion(L1)
- classify the different types of corrosion and identify their prevention methods(L3)

Unit IV **8L**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the different types, causes and effects of Wear(L2)
- use the concept of decision tree for fault tracing in machine tools(L4)
- build decision trees for different machine tools including pump, air compressor etc(L4)
- classify the different types of faults in machine tools and their causes(L3)

Unit V **10L**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the concept of periodic inspection and its need(L2)
- list the common troubles and remedies of electric motor(L1)
- define the need for preventive maintenance and list its steps(L3)
- elaborate the steps/procedure of periodic and preventive maintenance of diesel generating sets, pumps etc. (L2)

Text Book(s):

1. Lindley R. Higgins, Lester Coridon Morrow, Maintenance Engineering Handbook, Da Information Services, 1977.
2. H. P. Garg, Maintenance Engineering, S. Chand and Company, 1987.
3. Audels, Pump-hydraulic Compressors, Mc Graw Hill Publication, 1992.
4. Winterkorn, Hans, Foundation Engineering Handbook, Chapman & Hall London, 1975

Course Outcomes:

Upon successful completion of the course, the student will be able to

1. describe the different facets and aspects of industrial systems safety(L2)
2. demonstrate the use of tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings(L4)
3. define the function and list the types of maintenance activities(L1)
4. describe the concept of wear and corrosion mechanisms and their prevention methods(L2)
5. enumerate the different faults and their tracing mechanisms (L3).

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		1						2				1	
2		1						2				1	
3		1						2				1	
4		1						2				1	

5		1						2				1	

1-Low, 2- Medium and 3- High Correlation

20EOE746: OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

Course Description:

Optimization problems arise in all walks of human activity- particularly in engineering, business, finance and economics. The simplest optimization problems are linear in nature which may be subject to a set of linear constraints. This course will equip the student with the expertise to mathematically model real life optimization problems as Linear Programming (Optimization) Problems and subsequently educate the student to solve these models with the help of the available methods.

Course Objectives

- to impart knowledge on developing mathematical formulation for linear programming and transportation problem
- to familiarize the student in the construction of the required activities in an efficient manner to complete it on or before a specified time limit and at the minimum cost.
- to expose the development of mathematical model for interactive decision-making situations, where two or more competitors are involved under conditions of conflict and competition.
- to illustrate PERT and CPM techniques for planning and implementing projects.
- To impart the knowledge of formulating and analysis of real life problems using advanced tools and techniques for resource optimization
- to provide frameworks for analyzing waiting lines using advanced queuing theory concepts

Unit I **8L**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Learning Outcomes

After completing this unit, the student will be able to

- identify and develop operational research models from the verbal description of the real system. **[L4]**
- understand the classification systems of effective Inventory control models**[L2]**

Unit II **8L**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Learning Outcomes

After completing this unit, the student will be able to

- translate a real-world problem, given in words, into a mathematical formulation. **[L2]**
- utilize the mathematical tools that are needed to solve optimization problems. **[L2]**

Unit III **8L**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Learning Outcomes

After completing this unit, the student will be able to

- describe the need and origin of the optimization methods**[L2]**
- classify optimization problems to suitably choose the method needed to solve the particular type of problem**[L3]**

Unit IV **8L**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Learning Outcomes

After completing this unit, the student will be able to

- choose linear programming problems to suitably choose the method needed to solve the particular type of problem**[L1]**
- identify industrial problems involved in inventory, MRP and scheduling**[L2]**

Unit V **8L**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Learning Outcomes

After completing this unit, the student will be able to

- identify the values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs in a real decision problem**[L2]**
- Apply the models to incorporate rational decision-making process in real life

situations.**[L3]**

- Analyze various modeling alternatives & select appropriate modeling techniques for a given situation.. **[L3]**

Text Book(s):

1. H.A. Taha, Operations Research, An Introduction, Prentice Hall of India, 2008
2. H.M. Wagner, Principles of Operations Research, Prentice Hall of India, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, 2008
4. Hitler Libermann Operations Research: McGraw Hill Publishers, 2009
5. Pannerselvam, Operations Research: Prentice Hall of India, 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India, 2010

Course Outcomes:

After the successful completion of the course, the students will be able to:

1. Understand the basic concepts of different advanced models of operations research and their applications. (L2)
2. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action. (L4)
3. Apply the models to incorporate rational decision-making process in real life situations. (L4)
4. Analyze various modeling alternatives & select appropriate modeling techniques for a given situation. (L3)
5. Validate output from model to check feasibility of implementations. (L5)
6. Create innovative modeling frameworks for a given situation. (L6)

CO-PO MAPPING

	POs										**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		3						2				2	
2		3						2				2	
3		3						2				2	
4		3						2				2	
5		3						2				2	

1-Low, 2- Medium and 3- High Correlation

20EOE748: COST MANAGEMENT OF ENGINEERING PROJECTS

L	T	P	C
3	0	0	3

Course Description:
This course will equip the student with the expertise to mathematically model engineering projects and use effective methods and techniques to plan and execute engineering activities.

Course Objectives

- to introduce the basic principles of strategic cost management and the related terminology
- to familiarize the project planning and execution process involving technical/nontechnical activities
- to acquaint the student with detailed engineering activities and their cost management analysis
- to impart the knowledge of cost analysis and profit planning of engineering projects
- to familiarize the quantitative techniques for optimization of budget allocation

Unit I **8L**

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the cost concepts in decision making(L2)
- define the various costs involved in the cost management process(L2)
- list the objectives of cost control(L2)
- identify the different fields of a database for operational control(L2)

Unit II **8L**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning of a project and list the different types(L2)
- identify the measures to manage cost overruns(L2)
- describe the various stages of project execution from conception to commissioning(L2)
- plan the proper order of technical/nontechnical activities as part of project execution(L2)

Unit III **8L**

Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Learning Outcomes

After the completion of this unit, the student will be able to

- identify the different clearance norms required in the pre-project execution phase(L2)
- describe the hierarchy of project team and identify the role of each member(L2)
- list the different contents of project contracts(L2)
- present the project cost control and planning through bar charts, network diagrams etc(L2)

Unit IV **8L**

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the cost behavior and profit planning(L2)
- distinguish between marginal costing and absorption costing(L2)
- analyze the variance of standard costing(L2)
- analyze the pricing strategies in project costing(L2)
- identify the quality measures satisfying the appropriate constraints(L2)

Unit V **10L**

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory

Learning Outcomes

After the completion of this unit, the student will be able to

- define and compare the different budgeting strategies(L2)
- model the cost management as a linear programming problem(L2)
- measure the divisional profitability and decide the appropriate pricing(L2)

Textbook(s):

1. Charles T. Horngren, Srikant M. Datar, George Foster, Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2006.

References:

1. Charles T. Horngren, George Foster, Advanced Management Accounting, Greenwood Publishing, 2001.
2. Robert S Kaplan, Anthony A. Alkinson, Management & Cost Accounting, 1998.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting, Wheeler Publisher, 2004.
4. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book, 2006.

Course Outcomes:

After the successful completion of the course, the students will be able to

- list the basic principles of strategic cost management and define the related terminology(L1)
- plan the project execution process involving technical/nontechnical activities(L4)
- describe the detailed engineering activities and their cost management analysis(L2)
- carry out the cost analysis and profit planning of engineering projects(L5)
- utilize quantitative techniques for optimization of budget allocation(L6)

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1		1						2				2	
2		1						2				1	
3		1						2				1	
4		1						2				1	
5		2						2				1	

1-Low, 2- Medium and 3- High Correlation

20EOE752: WASTE TO ENERGY

L	T	P	C
3	0	0	3

Course Description:

This course introduces the basic principles and different technologies of converting waste to energy. Student will be able to appropriately identify the methods and build biomass gasification systems of different capacities depending on application requirements.

Course Objectives

- to introduce the classification of waste for its usefulness in preparing different fuels
- to familiarize the biomass pyrolysis process and its yield issues
- to acquaint the student with biomass gasification processes and construction arrangements
- to impart the types and principles of biomass combustors
- to familiarize the calorific values and composition of biogas resources

Unit I **8L**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Learning Outcomes

After the completion of this unit, the student will be able to

- distinguish between different types of waste (L1)
- classify the different types of waste for manufacturing different types of fuel (L3)
- identify the different conversion devices and their applications(L4)

Unit II **8L**

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyro-lytic oils and gases, yields and applications.

Learning Outcomes

After the completion of this unit, the student will be able to

- classify the different types of pyrolysis methods based on speed(L1)
- describe the different methods of manufacturing charcoal (L2)
- explain the chemical processes involved in the manufacture of pyro-lytic oils and gases(L2)

Unit III **8L**

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the design, construction and operation of different gasifiers(L2)
- describe the burner arrangement for thermal heating(L2)
- elaborate the gasifier engine arrangement for equilibrium and kinetic considerations(L3)

Unit IV **8L**

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the basic principle of biomass combustors(L2)
- classify different combustors based on their capacity and efficiency(L3)
- describe the construction and operation of fixed bed inclined grate, fluidized bed combustors (L2)

Unit V **10L**

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the properties of biogas(L1)
- elaborate the design, construction and operation of biogas plant(L2)
- classify the different biomass resources and their conversion process(L3)
- distinguish between different biogas plants and identify their applications(L5)

Text Book(s)

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Outcomes:

After the successful completion of the course, the student will be able to

1. classify different types of waste for their usefulness in preparing different fuels(L3)
2. describe the biomass pyrolysis process and its yield issues(L2)

3. outline the different biomass gasification processes and their construction arrangements(L3)
4. explain the types and principles of biomass combustors(L2)
5. analyze the calorific values and composition of biogas resources(L5)

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	1												1
2	1												1
3	1												1
4	1												1
5													1

1-Low, 2- Medium and 3- High Correlation

20EAC741: ENGLISH FOR RESEARCH PAPER WRITING

L	**T**	**P**	**C**
2	**0**	**0**	**0**

Course Description:

This course introduces the student, to the different aspects of research paper writing including planning, preparation, layout, literature review write-up etc. Specifically the perspective and style of writing in different sections of a research paper is highlighted. Students will exposed to English language skills relevant to research paper writing.

Course Objectives:

- To write clearly, concisely and carefully by keeping the structure of the paper in mind.
- To use standard phrases in English and further improve his command over it.
- To write with no redundancy, no ambiguity and increase the readability of the paper.
- To plan and organize his paper by following a logical buildup towards a proper conclusion.
- To decide what to include in various parts of the paper.
- To write a suitable title and an abstract in order to attract the attention of the reader.
- To identify the correct style and correct tense.
- To retain the scientific value of the paper by using minimum number of words.

Unit I **5L**

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Learning Outcomes:

After the completion of this unit, the student will be able to

- To know the expectations of various journals and referees
- To know the typical structure of a paper
- Learn to put words in a sentence in the correct order
- To write short and clear sentences from the very beginning of the paper
- To increase the readability of the paper by making it easy to read and 100% clear
- Learn to be concise without losing any important content
- To avoid some typical grammar mistakes made in research papers

Unit II **5L**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Learning Outcomes:

After the completion of this unit, the student will be able to

- Learn to make useful contribution worth recommending for publication
- Learn good use of language to make readers notice the key findings
- Learn to anticipate or predict possible objections to the claims made in the paper
- To understand what is plagiarism, and how to paraphrase other people's work
- Learn to attract the right kind of readers with a suitable title
- Learn to sell the abstract to potential readers by attracting their curiosity

Unit III **6L**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Learning Outcomes:

After the completion of this unit, the student will be able to

- have a deep knowledge about everything that has been previously written on the topic and decide what is important to know in Introduction.
- Learn to provide the right amount of literature regarding the sequence of events leading up to the current situation in the Literature review

Unit IV **6L**

Writing Skills: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Learning Outcomes:

After the completion of this unit, the student will be able to

- Learn to describe the materials used in experiments and/or the methods used to carry out the research
- The key skill is in reporting the results simply and clearly
- Learn to structure the Discussion and satisfy the typical requirements of the referees
- Learn to provide a clear and high-impact take-home message in the conclusion

Unit V **6L**

Good Paper Writing: Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Learning Outcomes:

After the completion of this unit, the student will be able to

- Learn various lists of frequently used phrases that have a general acceptance in all disciplines and use in specific sections of the paper
- Learn various kinds of things one should look for when doing the final check

Text Book (s):

1. Goldbort R, Writing for Science, Yale University Press, 2006
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006
3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM, Highman, 1998.

References:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Course Outcomes:

By the end of the course the students will be able to:

- Frame the structure of the paper precisely. (L2).
- Avoid repetition and mistakes in the paper and increase its readability. (L3).
- Decide on the content to be included in various parts of the paper. (L5).
- Identify whether to use personal or impersonal style in the paper. (L5).
- Attract the attention of the reader by providing a suitable title and an appropriate abstract. (L6).

CO-PO MAPPING

	POs										**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1									3				
2									3				

3									3				
4									3				
5									3				

1-Low, 2- Medium and 3- High Correlation

20EAC742: DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Course Description:

This course is intended to provide fundamental understanding of different aspects of Disaster Management. It will expose the students to the concept and functions of Disaster Management and to build competencies of Disaster Management professionals and development practitioners for effective supporting environment as put by the government in legislative manner. It would also provide basic knowledge, skills pertaining to Planning, Organizing and Decision-making process for Disaster Risk Reduction.

Course Objectives

- to provide students an exposure to disasters, their significance, types & Comprehensive understanding on the concurrence of Disasters and its management.
- to ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention, risk reduction and the basic understanding of the research methodology for risk reduction measures.
- equipped with knowledge, concepts, and principles, skills pertaining to Planning, Organizing, Decision-making and Problem solving methods for Disaster Management.
- to develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Unit I **5L**

Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning, list the factors and mention the significance of disaster
- distinguish between hazard and disaster
- compare manmade and natural disaster

- list the types of disaster and describe their magnitude

Unit II **5L**

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning, list the factors and mention the significance of disaster
- distinguish between hazard and disaster
- compare manmade and natural disaster
- list the types of disaster and describe their magnitude

Unit III **6L**

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the seismic zones and their characteristics
- identify the areas prone to floods and droughts
- distinguish between landslides and avalanches
- identify areas prone to cyclonic and costal hazards
- enumerate the post disaster diseases and epidemics

Unit IV **6L**

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, media reports: governmental and Community Preparedness.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the monitoring of phenomena triggering a disaster/hazard
- evaluate the risk with the use of remote sensing and meteorological data
- list the governmental and community measures for disaster preparedness

Unit V **6L**

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Learning Outcomes

After the completion of this unit, the student will be able to

- define and list the elements of disaster risk
- enumerate the measures for risk reduction
- apply the techniques of risk assessment
- identify the means of people's participation in risk assessment

Text Book(s):

1. R. Nishith, Singh A.K., Disaster Management in India: Perspectives, issues and strategies, New Royal Book Company., 2008.
2. Sahni, Pardeep, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi., 2012
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep and Deep Publication, 2007.

Course Outcomes:

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

1. Acquire knowledge about disasters, their significance, types & Comprehensive understanding on the concurrence of Disasters and its management.
2. Understand the relationship between vulnerability, disasters, disaster prevention, risk reduction and the basic understanding of the research methodology for risk reduction measures.
3. Understand the concepts, and principles, skills pertaining to Planning, Organizing, Decision-making and Problem solving methods for Disaster Management.
4. Plan disaster management activities and specify measure for risk reduction (L3)
5. Apply risk assessment techniques in real life disaster scenarios(L4).

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1	2							1	1				
2								2					
3								2					

4										1			
5								1					

1-Low, 2- Medium and 3- High Correlation

20EAC743: SANSKRIT FOR TECHNICAL KNOWLEDGE

L	T	P	C
2	0	0	0

Course Description:

This course is intended to expose the student to the fundamentals of Sanskrit language and its technical utility in forming the core principles of many engineering branches. Students taking this course shall be able to relate the core principles of engineering branches to semantics of Sanskrit language

Course Objectives

- to provide the knowledge of Sanskrit alphabets
- to expose the students to the basic grammar and sentence formation in past/present/future tenses
- to provide a classification of Sanskrit literature and its associated roots
- to demonstrate the relation of core engineering principles to the roots of Sanskrit literature

Unit I **9L**

Alphabets in Sanskrit,Past/Present/Future Tense,Simple Sentences.

Learning Outcomes

After the completion of this unit, the student will be able to

- define and list the elements of disaster risk
- enumerate the measures for risk reduction
- apply the techniques of risk assessment

Unit II **9L**

Order, Introduction of roots, Technical information about Sanskrit Literature.

Learning Outcomes

After the completion of this unit, the student will be able to

- classify the different branches of Sanskrit literature
- describe the order and roots of Sanskrit literature
- relate the applicability of Sanskrit literature to technical principles

Unit III **9L**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Learning Outcomes

After the completion of this unit, the student will be able to

- relate the technical concepts of engineering to principles of electrical technology
- relate the technical concepts of engineering to principles of mechanical engineering
- apply the use of Sanskrit knowledge to describe the mathematical principles

Text Book(s):

1. Dr.Vishwas, Abhyaspustakam, Samskrita Bharti Publication, New Delhi, 2005.
2. Vempati Kutumb Shastri, Teach Yourself Sanskrit, Prathama Deeksha, Rashtriya Sanskrit Sansthanam, New Delhi Publication, 2003.
3. Suresh Soni, India's Glorious Scientific Tradition, Ocean books, New Delhi, 2011.

Course Outcomes:

After successful completion of the course, the student will be able to

- get a working knowledge in illustrious Sanskrit, the scientific language in the world **(L1).**
- get a Learning of Sanskrit to improve brain functioning **(L3).**
- develop the logic in mathematics, science & other subjects with principles of Sanskrit **(L2)**.
- explore the huge knowledge from ancient literature with the help of Sanskrit **(L4)**.
- understand the engineering concepts with the help of Sanskrit (L2)

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								1					
4								1					
5								1					

1-Low, 2- Medium and 3- High Correlation

20EAC744: VALUE EDUCATION

L	T	P	C
2	0	0	0

Course Description:
This course is intended to expose the student to the need for human values and methods to cultivate them for leading an ethical life with good moral conduct. Students taking this course will be able to experience a change in personal and professional behavior with these ethical principles guiding him throughout life

Course Objectives

- to expose the student to need for values, ethics, self-development and standards
- to make the student understand the meaning of different values including duty, devotion, self-reliance etc.
- to imbibe the different behavioral competencies in students for leading an ethical and happy life
- to expose the student to different characteristic attributes and competencies for leading a successful, ethical and happy profession life.

Unit I **7L**

Values and self-development –social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

Learning Outcomes
After the completion of this unit, the student will be able to

- define the social values and individual attitudes for self-development
- describe the Indian vision of humanism
- distinguish between moral and non-moral acts
- list the standards and value principles for moral conduct

Unit II **7L**

Importance of cultivation of values. Sense of duty. Devotion, self-reliance. Confidence, concentration. Truthfulness, cleanliness. Honesty, humanity. Power of faith, national unity. Patriotism, love for nature, discipline.

Learning Outcomes
After the completion of this unit, the student will be able to

- describe the importance of cultivating values
- list the different traits of self-developed individual

- explain the need for loving nature/country/humanity

Unit III **7L**

Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the benefits of positive thinking, integrity and discipline
- list the different methods for avoiding fault finding, anger
- explain the methods to overcome suffering, religious intolerance, self-destructive habits

Unit IV **7L**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the science of reincarnation
- explain the relation between self-management and good health
- elaborate the role of different religions in reaching the common goal
- list the different techniques for mind-control to improve personality and studies

Text Book(s):

1. Chakroborty S.K., "Values and ethics for organizations: Theory and Practice", Oxford University Press, 1998.

Course Outcomes:

After successful completion of the course, the student will be able to

1. appreciate the need for human values and methods for self-development.
2. elaborate the different traits and benefits of a self-developed individual.
3. list the different attributes of self-developed individual.
4. elaborate the role and scope of books/faith/health/religions in character building and competence development.
5. understand the importance of of nonviolence.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								1					
4								1					
5								1					

1-Low, 2- Medium and 3- High Correlation

20EAC745: CONSTITUTION OF INDIA

L	**T**	**P**	**C**
2	**0**	**0**	**0**

Course Description:

This course is intended to expose the student to the philosophy of Indian constitution. Students will be able to understand their fundamental rights/duties and governance structure. Students also appreciate the role of election commission in establishing a democratic society.

Course Objectives

- to familiarize the student about the need for a constitution
- to make the student understand the role of constitution in a democratic society
- to acquaint the student with key constitutional features and fundamental rights of a citizen
- to impart the organs of governance and local administration hierarchy and their responsibilities
- to familiarize the student with the role, responsibilities and administration hierarchy of election commission

Unit I **5L**

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working). **Philosophy of the Indian Constitution**: Preamble, Salient Features

Learning Outcomes

After the completion of this unit, the student will be able to

- list the outline of drafting committee and their roles in the making of Indian constitution
- describe the need and role of a constitution in a democratic society
- elaborate the salient features of Indian constitution

Unit II **5L**

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Learning Outcomes
After the completion of this unit, the student will be able to

- list the fundamental rights of a citizen
- explain the intricacies in the different rights
- elaborate the fundamental duties of a citizen
- describe the principles of state policy

Unit III **6L**

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Learning Outcomes
After the completion of this unit, the student will be able to

- present the hierarchy of governance
- list the role/responsibilities/powers of different organs of governance
- elaborate the guidelines for appointment/transfer of judges

Unit IV **6L**

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Learning Outcomes
After the completion of this unit, the student will be able to

- describe the administrative organizational hierarchy of municipalities and panchayats
- appreciate the role/responsibilities/powers of mayor, CEO, elected officials
- appreciate the importance of grass root democracy

Unit V **6L**

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Learning Outcomes
After the completion of this unit, the student will be able to

- describe the administrative hierarchy of election commission
- elaborate the roles/responsibilities/powers of election commissioners at different levels of hierarchy
- outline the welfare activities of SC/ST/OBC/Women by different bodies

Text Book(s):

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1/e, 2015.
3. M. P. Jain, Indian Constitution Law, 7/e, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

After successful completion of the course, the student will be able to

- describe the philosophy and salient features of Indian constitution.
- list the constitutional rights and duties of a citizen.
- elaborate the central and local administrative hierarchy and their roles.
- describe the roles/responsibilities/powers of different governing and administrative bodies.
- explain the structure/functioning and power of election commission.

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								1					
4								1					
5								1					

1-Low, 2- Medium and 3- High Correlation

20EAC746: PEDAGOGY STUDIES

L	T	P	C
2	0	0	0

Course Description:
This course is aimed to familiarizing the student with pedagogical principles, practices and methodologies. This course is intended for students interested in pursuing a career in teaching and research.

Course Objectives

- to familiarize the student about the need for pedagogy studies, background and conceptual framework
- to expose the student to pedagogical practices in formal/informal classrooms
- to acquaint the student with type of curriculum and guidance materials for effective pedagogy
- to familiarize the student with classroom practices and curriculum assessment procedures
- to make the student understand the effect of undertaking research on teaching quality

Unit I **5L**

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the aim and rationale behind teacher education
- classify the different theories of learning
- elaborate the need and role of curriculum, teacher education

Unit II **5L**

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the different pedagogical practices used by teachers in formal and informal classrooms
- explain the pedagogical practices employed in developing countries
- enumerate the duties of faculty in terms of teaching, research, consultancy, administration

Unit III **6L**

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the measures for effective pedagogy
- identify the different documentation required to formalize curriculum implementation and quality assessment
- describe the teachers attitudes and beliefs in pedagogic strategies

Unit IV **6L**

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the organizational hierarchy in a school administration system
- list the different barriers to learning
- enumerate the methods to overcome limited resources and handle large class sizes
- describe the follow-up support and peer-support in classroom practices

Unit V **6L**

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the need for and role of research in teaching profession
- list the different research activities to be taken up by teachers
- describe the impact of research on teaching quality and learning process

Text Book(s):

1. Ackers J, Hardman F, Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261, 2001
2. Agrawal M, Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379, 2004.

3. Akyeampong K, Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID., 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282., 2013.
5. Alexander RJ, Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell., 2001.
Chavan M, Read India: A mass scale, rapid, 'Learning to Read' campaign., 2003.

Course Outcomes:

After successful completion of the course, the student will be able to

1. describe the theories of learning and conceptual framework of pedagogy
2. explain the pedagogical practices used by teachers in formal and informal classrooms
3. visualize the administrative hierarchy of schools and colleges and define the role
4. appreciate the need for research and define the future direction of teaching career
5. describe the impact of curriculum and assessment on the teaching learning process of a student

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								1					
4								1					
5								1					

1-Low, 2- Medium and 3- High Correlation

20EAC747: STRESS MANAGEMENT BY YOGA

L	T	P	C
2	0	0	0

Course Description:
This course is aimed to familiarize the student with basic principles of yoga and different physical/mental practices for managing mind and body. This course helps the student in managing stress during education, home and workplace. Further, principles learnt in this course help in building overall personality for a stress-free, happy and independent life.

Course Objectives

- to familiarize the student about eight parts of yoga and their significance
- to expose the student to the importance and meaning of Yam and Niyam
- to make the student understand the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc
- to introduce the different yogic poses with a knowledge of their benefits for mind and body
- to familiarize the effect of different types of breathing techniques in concept and in activity

Unit I **9L**

Definitions of Eight parts of yoga (Ashtanga).

Learning Outcomes

After the completion of this unit, the student will be able to

- list the eight parts of yoga
- describe the effects of different parts of yoga on mind and body
- elaborate the importance of yoga in stress management and personality development

Unit II **9L**

Yam and Niyam.
Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Learning Outcomes

After the completion of this unit, the student will be able to

- elaborate the importance of Yam and Niyam
- describe the meaning and significance of Ahinsa, satya, astheya etc
- explain the need for shaucha, santosh, tapa, swadhyay in leading a healthy and fruitful life

Unit III **9L**

Asan and Pranayam

i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its Effects-Types of pranayam.

Learning Outcomes

After the completion of this unit, the student will be able to

- demonstrate the different physical asanas and explain their physical and phychological effects
- demonstrate the different breathing techniques and describe their physical and mental effects
- distinguish between different types of pranayamam

Text Books

1. Janardan, Yogic Asanas for Group Tarining-Part-I, Swami Yogabhyasi Mandal, Nagpur
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama, Kolkata

Course Outcomes:

After successful completion of the course, the student will be able to

1. describe the eight parts of yoga and their significance
2. explain the the importance and meaning of Yam and Niyam
3. define the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc.
4. demonstrate the different yogic poses and explain their benefits for mind and body
5. demonstrate the different types of breathing techniques and explain their physical and mental benefits

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								3					
4								1			1		
5								2			1		

1-Low, 2- Medium and 3- High Correlation

20EAC748: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L	T	P	C
2	0	0	0

Course Description:
This course is aimed to familiarize the student with life enlightenment skills for personality development. This course helps the student in building his holistic personality through human values, ethics and spiritual attributes.

Course Objectives

- to familiarize the student to good personality traits through moral stories
- to make the student understand the goal of human life and importance of good personality in reaching the goal
- to expose the student to the study of Shrimad-Bhagwad-Geeta for developing his/her personality and achieve the highest goal in life
- to familiarize the student to leadership skills for driving nation and mankind to peace and prosperity
- to expose the role of Neetishatakam for developing versatile personality of students.

Unit I **9L**

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's).

Learning Outcomes
After the completion of this unit, the student will be able to

- describe the moral stories illustrating the traits of good personality
- define the meaning and importance of wisdom, pride, heroism, virtue etc
- identify do and donts in life from the foundations of human morals/ethics

Unit II **9L**

Approach to day to day work and duties.
Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.

Learning Outcomes
After the completion of this unit, the student will be able to

- describe the characteristics and principles of bhakti yogam, jnana yogam and karma yogam
- identify the use of different yogic characteristics in different activities of daily life/duties
- apply the use of yogic principles for leading a stress-free, happy and fruitful life with good developed personality

Unit III **9L**

Statements of basic knowledge.
Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18
Personality of Role model. Shrimad BhagwadGeeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

Learning Outcomes
After the completion of this unit, the student will be able to

- list the characteristics of role model proposed by verses of bhagavad gita
- explain the methods for obtaining life enlightenment through the practice of four yoga appropriately
- describe the characteristics of karma yogi/jnana yogi for developing leadership personality

Text Book(s):

1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram (Publication Department), Kolkata
2. P. Gopinath, Bhartrihari's Three Satakam (Niti-Sringar-vairagya), Rashtriya Sanskrit Sansthanam, New Delhi.

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

- List the different parables of neethisathakam and identify their morals
- enumerate the different traits of human personality for life enlightenment
- describe the leadership attributes for driving nation and mankind to peace and prosperity
- explain the applicability of different types of yoga to day-to-day work and duties resulting in responsible personality
- become familiarize to leadership skills for driving nation and mankind to peace and prosperity

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								1					
4								1					
5								1					

1-Low, 2- Medium and 3- High Correlation

20EAC750: DEVELOPING SOFT SKILLS AND PERSONALITY

L	T	P	C
3	0	0	0

Course Description:

Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The course aims to cause a basic awareness within the students about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality.

Course Objectives

- to familiarize the student to the criteria for self-assessment and significance of self-discipline
- to expose the student to attitudes, mindsets, values and beliefs
- to acquaint the student to plan career and goals through constructive thinking
- to enable the student to overcome barriers for active listening and persuasive speaking
- to familiarize the skill of conducting meetings, writing minutes and involving in active group discussions

Unit I **8L**

Self-Assessment; Identifying Strength & Limitations; Habits, Will-Power and Drives; Developing Self-Esteem and Building Self-Confidence, Significance of Self-Discipline

Learning Outcomes

After the completion of this unit, the student will be able to

- identify strengths & limitations through self-assessment(L3)
- list the attributes of personalities will good will-power and self-drives(L1)
- describe the reasons for building self-esteem and self-confidence(L2)
- explain the significance of self-discipline (L2)

Unit II **8L**

Understanding Perceptions, Attitudes, and Personality Types: Mind-Set: Growth and Fixed; Values and Beliefs

Learning Outcomes

After the completion of this unit, the student will be able to

- define the characteristics of different perceptions, attitudes and personality types(L1)
- distinguish between fixed and growing mindsets (L3)
- define the importance and meaning of values and beliefs(L2)

Unit III **8L**

Motivation and Achieving Excellence; Self-Actualization Need; Goal Setting, Life and Career Planning; Constructive Thinking

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the need for having high motivation and achieving excellence(L2)
- define the need for self-actualization(L1)
- plan the life and career goals based on self-assessment(L4)
- explain the attributes of constructive thinking(L2)

Unit IV **8L**

Communicating Clearly: Understanding and Overcoming barriers; Active Listening; Persuasive Speaking and Presentation Skills.

Learning Outcomes

After the completion of this unit, the student will be able to

- self-assess the barriers for communicating clearly (L4)
- list the attributes of active listening(L1)
- describe the minimal aspects of effective presentation(L2)
- organize ideas resulting a persuasive talk(L3)

Unit V **8L**

Conducting Meetings, Writing Minutes, Sending Memos and Notices; Netiquette: Effective E-mail Communication; Telephone Etiquette; Body Language in Group Discussion and Interview.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the format and structure of writing meeting minutes(L2)

- identify the essential components of memos and notices(L3)
- explain the principles of effective email communication(L2)
- list the basic etiquette of telephone conversation(L1)
- describe the effective body traits during group discussion and interviews(L2)

Text Books

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman& Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.

Course Outcomes:

After successful completion of the course, the student will be able to

- carry out self-assessment and describe the significance of self-discipline (L4).
- define, classify and compare attitudes, mindsets, values and beliefs (L3).
- plan career and goals through constructive thinking and personal assessment (L4).
- overcome barriers for active listening and persuasive speaking (L5)
- conduct meetings, write minutes and involve in active group discussions (L3)

CO-PO MAPPING

	POs										PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**
1								1					
2								1					
3								1					
4								1					
5								1					

1-Low, 2- Medium and 3- High Correlation

20EME792: TECHNICAL SEMINAR

L	T	P	C
0	0	4	2

Each student shall survey a technical topic related to a chosen specialization and prepare/submit a report in a specified format. Each student has to prepare a power point presentation on a selected technical topic with a novelty and get it evaluated by the faculty assigned for this purpose.

20EME881: PROJECT WORK I

L	T	P	C
0	0	26	13

Each student is required to submit a report of first part of project work i.e. about the problem definition, literature review and methodology to be adopted including experiments and tests to be performed on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester end.

20EME882: PROJECT WORK II

L	T	P	C
0	0	26	13

Each student is required to submit a detailed project report about the work on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester and Final evaluation will be done at the end of semester as per the guidelines decided by the department from time to time. The candidate shall present/publish one paper in national/international conference/seminar/journal of repute. However candidate may visit research labs/institutions with the due permission of chairperson on recommendation of supervisor concerned.