Appendix - XXI

# **UNIVERSITY OF DELHI**

## NETAJI SUBHAS INSTITUTE OF TECHNOLOGY

## CHOICE BASED CREDIT SYSTEM

## SCHEME OF COURSES FOR

## M.TECH. (PRODUCTION ENGINEERING)

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#### PREAMBLE

#### I. INTRODUCTION

Higher education is very important for the growth and development of any country. It is a living organ and requires continuous changes to ensure the quality of education. National Knowledge Commission and University Grants Commission have recommended many academic reforms to address the challenges of today's networked globalized world. People are coming together with the help of new technologies which is resulting towards new aspirations, expectations, collaborations and associations. The concept of "work in isolation" may not be relevant and significant anymore. The UGC guidelines on adoption of Choice Based Credit System may be an important step to revamp the processes, systems and methodologies of Higher Educational Institutions (HEIs). The teacher centric mode be changed to learner centric mode. Class room teaching and learning be made effective; relevant and interesting. Concepts and theories be explained with examples, experimentation and related applications.

A culture of discussions, arguments, interpretations, counter-interpretations, reinterpretations, and opposing interpretations must be established. Research should not only be confined to redefinition, extension and incremental change. Innovation & creativity should become an epicenter for all research initiatives. The most important capital is the human capital and thus the ultimate objective is to develop good human beings with utmost integrity & professionalism for this new world.

The Choice Based Credit System supports the grading system which is considered to be better than conventional marks system. It is followed in many reputed institutions in India and abroad. The uniform grading system facilitates student mobility across the institutions within and across the countries and also enable potential employers to assess the performance of the students. The Choice Based Credit System makes the curriculum interdisciplinary and bridge the gap between professional and liberal education.

Programme Educational Objectives (PEO) of the programme are as follows:

- Students will apply knowledge of Computer aided design, simulation, manufacturing to pursue successful career in the field of Mechanical Engineering.
- Students will become innovators, entrepreneurs to design and develop products and services to address social, technical and business challenges.
- Students will engross in lifelong learning such as higher studies, research and other continuous professional development activities

#### II. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions have been moving from the conventional annual system to semester system. Currently many of the institutions have already introduced the choice based credit system. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning. The credit based semester system

provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. It is desirable that the HEIs move to CBCS and implement the grading system.

#### A. Types of Courses

Courses are the subjects that comprise the M.Tech. Programme.

- 1. A course may be designed to comprise lectures, tutorials, laboratory work, field work, outreach activities, project work, vocational training, viva, seminars, termpapers, assignments, presentations, self-study etc. or a combination of some of these components.
- 2. The learning objectives and learning outcomes of each course will be defined before the start of a semester.
- 3. Courses are of two kinds: Core and Elective.
  - i. **Core Course** (**CC**): This is a course which is to be compulsorily studied by a student as a core requirement to complete the requirement of M.Tech. Production Engineering
  - ii. **Elective Course**: An elective course is a course which can be chosen from a pool of subjects. It is intended to support the discipline of study by providing an expanded scope, enabling exposure to another discipline/domain and nurturing a student's proficiency/skill. An elective may be of following types:
    - a) **Discipline Centric Elective (ED)**: It is an elective course that adds proficiency to the students in the discipline.
    - b) **Open Elective (EO):** It is an elective course taken from other engineering disciplines that broadens the perspective of an Engineering student.
- 4. Each course contributes certain credits to the programme. A course can be offered either as a full course (4 credits) or as a half course (2 credits). A full course is conducted with 3 hours of lectures and either 1 hour of tutorial or 2 hours of practical work per week. A half course is conducted with 2 hours of lectures.
- 5. A student of Postgraduate programme has to accumulate about 40% credits from the Core Courses and the remaining credits from the Elective Courses to become eligible for the award of degree/ diploma/ certificate programmes.

- 6. A course (full/half) may also be designed without lectures or tutorials. However, such courses may comprise Field work, Outreach activities, Project work, Vocational Training, Seminars, Self-study etc. or a combination of some of these.
- 7. A Project work/Dissertation is considered as a special course involving application of the knowledge gained during the course of study in exploring, analyzing and solving complex problems in real life applications. A candidate completes such a course on his own with an advisory support by a teacher/faculty member.

#### **B.** Examination and Assessment

The following system will be implemented in awarding grades and CGPA under the CBCS system.

**1.** Letter Grades and Grade Points: A 10-point grading system shall be used with the letter grades as given in Table 1 below:

Table 1. Orauco	and Oraue I onno
Letter Grade	Grade point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

#### Table 1: Grades and Grade Points

- 2. Fail grade: A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. If the student does not want to reappear in an elective subject (that is ED, EO *but not CC courses*) then he/she can re-register afresh for a new elective subject.
- **3.** Non-credit course: For non-credit courses, 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA. However, a student must get satisfactory to get the degree.
- 4. Fairness in Assessment: The CBCS promotes continuous evaluation system where end semester examinations weightage should not be more than 60%. The Departments should design their own methods for continuous evaluation. They have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi & teaching, learning methods. In this regard, the checks and

balances be implemented which enable Departments would effectively and fairly carry out the process of assessment and examination.

- **5.** Computation of SGPA and CGPA: The following procedure be used to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):
  - i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student, i.e.

$$SGPA(S_i) = \frac{\sum C_i \times G_i}{\sum C_i}$$

Where  $C_i$  is the number of credits of the i<sup>th</sup> course and  $G_i$  is the grade point scored by the student in the i<sup>th</sup> course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum C_i \times SGPA(S_i)}{\sum C_i}$$

Where  $S_i$  is the SGPA of the  $i_{th}$  semester and  $C_i$  is the total number of credits in that semester.

- iii. The SGPA and CGPA shall be rounded off to two decimal points and reported in the transcripts.
- iv. CGPA shall be converted into percentage of marks, if required, by multiplying CGPA with 10.

#### III. PROGRAMME STRUCTURE

- **1.** The M.Tech. Production Engineering programme span of four semesters, normally completed in 2 years.
- 2. The courses offered in each semester are given in the Semester-wise Course Allocation.
- **3.** The discipline centric subjects under CC and ED categories are listed for each discipline separately.
- 4. A course may have pre-requisite courses that are given in the **Semester-wise Course Allocation**. A student can opt for an elective only if he/she has fulfilled its prerequisites.
- 5. A student has to register for all electives before the start of a semester.

#### IV. COURSE CODIFICATION

The codes for various Postgraduate Programme are as follows:

- i. Department of Electronics and Communication Engineering:
  - 1. Signal Processing-ECSP
  - 2. Embedded System and VLSI-ECES
- ii. Department of Computer Engineering:
  - 1. Information System-COIS
- iii. Department of Instrumentation and Control Engineering:
  - 1. Process Control-ICPC
  - 2. Industrial Electronics-ICIE
  - 3. Mechatronics-ICMT
- iv. Department of Biotechnology:
  - 1. Biochemical Engineering -BTBC
  - 2. Bioinformatics-BTBF
- v. Manufacturing processes and Automation Engineering:
  - 1. CAD CAM-MACD
  - 2. Manufacturing process and Automation Engineering.-MAMP
  - 3. Production Engineering-MAPE
  - 4. Engineering Management-MAEM
  - 5. Nano Technology-MANT

The codes for Departmental core subjects and Domain-specific Electives are specific to each Discipline. The first two characters are derived from Departmental codes listed above.

For I semester, the codes are:

PEC01	CC
PEC02	СС
PED***	Elective
PED***	Elective
PED***	Elective
EO***	Open Elective

For II semester, the codes are:

PEC03	CC
PEC04	CC
PED**	Elective
PED**	Elective
PED**	Elective
EO***	Open Elective

For III semester, the codes are:

PEC05	Seminar
PEC06	Major Project
PED**	Elective
PED**	Elective
PED**	Elective

For IV semester, the codes are:

PEC07 Dissertation

#### V. EVALUATION SCHEME

The courses are evaluated on the basis of continuous assessments, mid-semester exams and end-semester exams. The weightage of each of these modes of evaluation for the different types of courses are as follows.

Type of	Continuous	Mid-	End-	Continuous	End-
Course	Assessment	Semester	semester	Assessment	semester
	(CA),	Exam	Exam	(CA), Lab	Exam
	Theory	(MS),	(ES),		(ES),
		Theory	Theory		Lab
CC/ED/EO	25	25	50	Nil	Nil
Theory with/					
without					
Tutorial					
CC/ED/EO	15	15	40	15	15
Theory with					
Practical					
Major	Nil	Nil	Nil	40	60
Project and					
Dissertation					

#### VI. EVALUATION AND REVIEW COMMITTEE

The Committee of Courses and Studies in each department shall appoint one or more Evaluation-cum-Review Committees (ERC), each committee dealing with one course or a group of courses. This ERC consists of all faculty members who are likely to teach such courses in the group. Normally Head of the department shall be ERC Chairman.

The ERC has the following functions-

- (i) To recommend appointment of paper setters/examiners of various examinations at the start of each semester.
- (ii) To prepare quizzes, assignments, test papers etc. for Continuous Assessment (CA), Mid-Semester examination (MS) and End Semester (ES) examination and to evaluate them. Normally, each concerned faculty member, who is also a member of ERC, will do this job for his/her class. However, in exceptional circumstances any part of the work may be entrusted to some other member of the ERC.
- (iii) To consider the individual representation of students about evaluation and take remedial action if needed. After scrutinizing, ERC may alter the grades awarded upward/downward. The decision of the ERC shall be final.

- (iv) To moderate assignments, quizzes etc. for courses given by each of the concerned faculty members for his/her class with a view to maintain uniformity of standards.
- (v) To review and moderate the MS and ES results of each course with a view to maintain uniformity of standards.
- (vi) To lay guidelines for teaching a course.

#### VII. ATTENDANCE, PROMOTION AND DETENTION RULES

- 1. A student should normally attend all the classes. However, a student will be allowed to appear in the examination if he/ she has put in a minimum of 75% attendance separately in each course for which he / she has registered. A relaxation up to a maximum of 25% may be given on the production of satisfactory evidence that (a) the student was busy in authorized activities, (b) the student was ill.
- 2. A student should submit the evidence to the fact 1(a) and / or 1(b) above within seven working days of resuming the studies. Certificates submitted later will not be considered.
- 3. No relaxation in attendance beyond 25% is permitted in any case.
- 4. A student may re-register for a course if he/ she want to avoid a decrement in the grades.
- 5. There shall be no supplementary examinations. A student who has failed in a course will have to re-register for the course in a subsequent year.
- 6. If the student does not want to reappear in an elective course (that is, ED, EO, but not CC courses) then he/she can re-register afresh for a new elective course.

#### VIII. DECLARATION OF RESULTS

- 1. The M. Tech (PE) programme consists of 82 credits. A student will be awarded the degree if he/she has earned all 82 credits.
- 2. CGPA will be calculated on the basis of the best 78 credits earned by the student.
- 3. The candidate seeking re-evaluation of a course shall apply for the same on a prescribed proforma along with the evaluation fee prescribed by the university from time to time only for the End Semester Examination within seven days from the date of declaration of result.
- 4. The Institution/University may cancel the registration of all the courses in a given semester if
  - i. The student has not cleared the dues to the institution/hostel.
  - ii. A punishment is awarded leading to cancellation of the student's registration.

#### IX. CURRICULUM MODIFICATION

The curriculum will be updated regularly within a period of 5 to 10 years since last revision, to keep pace with the advancements in the field of Production Engineering.

#### X. CENTRAL ADVISORY COMMITTEE

There shall be a Central Advisory Committee consisting of the following-

- a) Dean, Faculty of Technology, Chairman
- b) Dean PGS
- c) Head of Institution
- d) Heads of Departments running M.Tech Courses

#### **PROGRAMME OUTCOMES**

- An ability to apply knowledge of mathematics and engineering.
- An ability to design, analyze and interpret data using Engineering Management tools & techniques.
- An ability to design and develop a manufacturing system, process etc. to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
- An ability to function in multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- Responsiveness towards professionalism and ethics.
- An ability to communicate effectively.
- Domain knowledge necessary to understand the impact of engineering solution in a global and societal context.
- Recognition of the need for, and an ability to engross in lifelong learning.
- Knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- An ability to demonstrate the knowledge of engineering and management principles and apply these to manage the projects and its financial aspects.

#### SEMESTER-WISE COURSE ALLOCATION

#### M.TECH. PRODUCTION ENGINEERING (Full Time) SEMESTER I

CODE	Туре	COURSE OF	L	Т	P	С	EVALUATION (MARKS)							
		STUDY					The	Theory			ctical	Total		
							CA	MS	ES	CA	ES			
PEC01	CC	Casting &	3	0	2	4	15	15	40	15	15	100		
		Welding:												
		Processes &												
		Automation												
PEC02	CC	Theory of	3	0	2	4	15	15	40	15	15	100		
		Plasticity and												
		Metal Forming												
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100		
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100		
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100		
EO***	EO	Open Elective #	-	-	-	4	-	-	-	-	-	100		
		TOTAL		\$		24								
#: The LTI	P allocat	tion, Evaluation Sche	eme	and	Pre-	requisi	tes for	Electi	ive(s)	are gi	iven ir	Tables 2-3		

\$: The actual weekly load will depend upon the elective(s) chosen by the student

#### M.TECH. PRODUCTION ENGINEERING (Full Time) SEMESTER II

CODE	Туре	COURSE OF	L	Т	P	C	EVA	LUÁ	TION	N (M	ARKS	5)
		STUDY					The	ory		Prac	tical	Total
							CA	MS	ES	CA	ES	
PEC03	CC	Advanced	3	0	2	4	15	15	40	15	15	100
		Manufacturing										
		Processes										
PEC04	CC	Generative	3	0	2	4	15	15	40	15	15	100
		Manufacturing										
		Processes										
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PEO**	EO	Open Elective #	-	-	-	4	-	-	-	-	-	100
		TOTAL	9	5		24						
#: The LTH	P allocati	on, Evaluation Sche	me ai	nd Pı	e-re	quisit	es for	Electi	ive(s)	are gi	iven ir	Tables 2-3
\$: The actu	al weekl	y load will depend u	pon t	the e	lecti	ve(s)	chose	n by tl	he stu	dent		

#### M.TECH. PRODUCTION ENGINEERING (Full Time) SEMESTER III

CODE	Туре	COURSE OF	L	Т	P	С	EVALUATION (MARKS)						
		STUDY					Theory		Prac	ctical	Total		
							CA	MS	ES	CA	ES		
PEC05	CC	Seminar	0	0	4	2	-	-	-	40	60	100	
PEC06	CC	Major Project	0	0	-	6				40	60	100	
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100	
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100	
PED**	ED	Elective #	-	-	-	4	-		-	-		100	
		TOTAL		\$		20							
#·The I TP	allocati	on Evaluation Sch	eme	and	Pre-1	eanis	ites fo	or Ele	ctive(	are	given	in Tables	

#:The LTP allocation, Evaluation Scheme and Pre-requisites for Elective(s) are given in Tables 2-3.

\$: The actual weekly load will depend upon the elective(s) chosen by the student

#### M.TECH. PRODUCTION ENGINEERING (Full Time) SEMESTER IV

CODE	Туре	COURSE OF	L	Т	Р	С	<b>EVALUATION (MARKS)</b>					
		STUDY					The	ory		Prac	ctical	Total
							CA	MS	ES	CA	ES	
PEC07	CC	Dissertation	-	-	-	14	-	-	-	40	60	100
		TOTAL	-	-	-	14						

#### SEMESTER-WISE COURSE ALLOCATION-PART-TIME

#### M.TECH. PRODUCTION ENGINEERING (Part Time) SEMESTER I

CODE	Туре	COURSE OF	L	Т	Р	С	EVA	<b>EVALUATION SCHEME</b>				
		STUDY					Percentage (W			eightage)		
							The	ory		Practical		Total
							CA	MS	ES	CA	ES	
PEC01	CC	Casting &	3	0	2	4	15	15	40	15	15	100
		Welding: Processes										
		& Automation										
PEC02	CC	Theory of	3	0	2	4	15	15	40	15	15	100
		Plasticity and										
		Metal Forming										
EO***	EO	Open Elective #	-	-	-	4	-	-	-	-	-	100
		TOTAL	\$			12						
#: The LT	P alloca	tion, Evaluation Scher	me ai	nd Pi	re-re	quisit	es for	Elect	ive(s)	are gi	iven i	n Tables
2-3.												
\$: The actu	ial week	kly load will depend up	pon ti	he el	ectiv	ve(s)	choser	n by th	e stu	dent		

#### M.TECH. PRODUCTION ENGINEERING (Part Time) SEMESTER II

CODE	Туре	COURSE OF STUDY	L	Т	Р	C	EVA Perc	LUA	TION e (We	N SCI eighta	HEM ge)	E
							The	ory		Prac	tical	Total
							CA	MS	ES	CA	ES	
PEC03	CC	Advanced	3	0	2	4	15	15	40	15	15	100
		Manufacturing										
		Processes										
PEC04	CC	Generative	3	0	2	4	15	15	40	15	15	100
		Manufacturing										
		Processes										
EO***	EO	Open Elective #	-	-	-	4	-	-	-	-	-	-
		TOTAL		5		12						

#: The LTP allocation, Evaluation Scheme and Pre-requisites for Elective(s) are given in Tables 2-3

\$: The actual weekly load will depend upon the elective(s) chosen by the student

#### M.TECH. PRODUCTION ENGINEERING (Part Time) SEMESTER III

CODE	Туре	COURSE	L	Т	Р	С	EVALUATION SCHEME			E		
		OF STUDY					Percentage (Weightage)					
							The	ory		Prac	tical	Total
							CA	MS	ES	CA	ES	
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
		TOTAL		\$		12	-	-	-	-	-	100
#: The LTP allocation, Evaluation Scheme and Pre-requisites for Elective(s) are given in Tables												
2-3.												
\$: The actual v	veekly l	oad will depend u	pon t	he el	lectiv	ve(s)	chosei	n by tł	ne stu	dent		

#### M.TECH. PRODUCTION ENGINEERING (Part Time) SEMESTER IV

CODE	Туре	COURSE OF STUDY	L	Т	Р	С	<b>EVALUATION SCHEME</b> <b>Percentage (Weightage)</b>		E			
							The	ory		Prac	tical	Total
							CA	MS	ES	CA	ES	
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
		TOTAL		\$		12						

#: The LTP allocation, Evaluation Scheme and Pre-requisites for Elective(s) are given in Tables 2-3.

\$: The actual weekly load will depend upon the elective(s) chosen by the student

CODE	Туре	COURSE OF STUDY	L	Т	Р	C	EVALUATION SCHEME Percentage (Weightage)					
							The	ory		Prac	tical	Total
							CA	MS	ES	CA	ES	
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PED**	ED	Elective #	-	-	-	4	-	-	-	-	-	100
PEC06	CC	Major Project	-	-	-	6	-	-	-	40	60	100
		TOTAL		\$		14						
#: The LTP allocation, Evaluation Scheme and Pre-requisites for Elective(s) are given in Tables												
2-3.												
\$: The actua	al weekly l	oad will depend u	pont	the el	lectiv	/e(s)	chosei	n by tł	ne stu	dent		

#### M.TECH. PRODUCTION ENGINEERING (Part Time) SEMESTER V

#### M.TECH. PRODUCTION ENGINEERING (Part Time) SEMESTER VI

CODE			L	Т	Р	C	<b>EVALUATION SCHEME</b>					
							Perc	entag	e (We	eightag	ge)	
							The	ory		Prac	tical	Total
							CA	MS	ES	CA	ES	
PED**	ED	Elective #	-	-	-	4	-	-		-	-	100
PEC05	CC	Seminar	-	-	4	2	-	-	-	40	60	100
PEC07	CC	Dissertation	-	-	-	14	-	-	-	40	60	100
		TOTAL	\$			20						

#: The LTP allocation, Evaluation Scheme and Pre-requisites for Elective(s) are given in Tables 2-3.

\$: The actual weekly load will depend upon the elective(s) chosen by the student

TAB	TABLE 2A: LIST OF DISCIPLINE CENTRIC ELECTIVES WITH TUTORIAL										
	LTP Allocation			Evaluat	ion Sche	me					
L	Т	Р	CA	MS	ES	CA	ES				
3	1	0	25 25 50 -								
Code	Name of Elective			Pre-R	equisites	5					
PED01	Operation Research Production Manage	n & ement		]	NONE						
PED02	Artificial Intelligen	ce			NONE						
PED03	Design of Experim	ents			NONE						
PED04	Design of Facilities	3			NONE						
PED05	Design of Manager Information System	nent and	NONE								
PED06	Financial Managem	ent	NONE								
PED07	Work Study and Er	gonomics									
PED08	Reliability Enginee	ring			NONE						
PED09	Computational Met	hods			NONE						
PED10	Optimization Techr	niques			NONE						
PED11	IT in Manufacturin	g Enterprises			NONE						
PED12	Value Engineering		NONE								
PED13	Supply Chain Man	agement		]	NONE						
PED14	Maintenance Mana	gement	NONE								
PED15	Design for Manufa	cture			NONE						

TABL	E 2B: LIST OF DI	SCIPLINE CENTRIC	ELECT	IVES WI	TH PRA	CTICA	AL			
LTP Allocation				Evalua	tion Sch	eme				
L	Т	Р	CA	MS	ES	CA	ES			
3	0	2	15	15	40	15	15			
Code	Name of Elective	e		Pre-l	Requisit	es	•			
PED31	Advanced Mather Analysis	NONE								
PED32	2 Robotics			NONE						
PED33	Product Design ar	nd Manufacturing			NONE					
PED34	Computer Aided I	Manufacturing (CAM)			NONE					
PED35	Metrology		NONE							
PED36	Finite Element M	ethods			NONE					
PED37	Automation in M	anufacturing			NONE					
PED38	Flexible Manufac	turing Systems	NONE							
PED39	Design of Machir Tools	ne Tools and Cutting	NONE							
PED40	Mechatronics				NONE					
PED41	CAD and Geomet	ric Modeling			NONE					
PED42	Computer Program	nming and Interface			NONE					
PED43	Composite Materials				NONE					
PED44	Micro Electro Mechanical Systems				NONE					
PED45	CNC Operation and Programming			NONE						
PED46	Advanced Machir	ing Processes			NONE					

	TABLE 3 :       LIST OF OPEN ELECTIVES EO-***										
	LTP Allocation	)n		Evalu	ation Sc	heme					
L	Т	Р	CA	MS	ES	CA	ES				
3	1	0	25	25	50	-	-				
Code	Name of Elective			Pre	-Requisi	tes	1				
EO001	Technical Communication			None							
EO002	Disaster Managemen	nt	None								
EO003	Basics of Finance M	anagement			None						
EO004	Basics of Human Re Management	sources			None						
EO005	Project Management	t			None						
EO006	Basics of Corporate	Law			None						
EO007	Biological computin	g	None								
EO008	Basic of social scien	ce			None						
EO009	Entrepreneurship				None						
EO010	Social work		None								
EO011	IP and Patenting		None								
EO012	Supply Chain Manag and logistics	gement-Planning	None								
EO013	Organization Devel	opment			None						
EO014	Industrial Organizat Economics	ion and Managerial			None						
EO015	Global Strategy and	Technology	None								
EO016	D16 Engineering System Analysis and Design			None							
EO017	Biology for Engineers			None							
EO018	D018Energy, Environment and Society			None							
EO019	Public Policy and G	overnance			None						

## **DETAILED SYLLABUS FOR CORE COURSES**

Course No	Title of the Course	Course Structure	Pre-Requisite					
PEC01	Casting and Welding:	L-T-P:3-0-2	None					
	Processes &							
	Automation							
COURSE OUTCOM	ES (COs)							
• To inculcate the prand alloys.	inciple, thermal and meta	allurgical aspects during	solidification of metal					
• To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving sound casting.								
• To impart knowled	dge about welding beha	vior of machine and p	rocess during welding,					
analysis of commo	on and newer welding	techniques and metallu	rgical and weldability					
aspects of different	common engineering ma	aterials.	-					
COURSE CONTENT								
Introduction; Introduct	ion to Manufacturing							
CASTING								
Expendable Mold Cas	sting Processes; mold ty	pes, sand casting types	s, pattern designs/mold					
designs, gating systems	s, cores.							
Casting fundamentals	of Sand Casting; solidi	fication of metals, cast	t structures, fluidity of					
molten metals, heat tra	nsfer, shrinkage, casting	defects, foundry method	ls, cast alloys.					
Investment Casting Pr	ocesses; investment cast	ing types, mold design,	ceramic mold casting,					
shell mold casting.								
Permanent Mold Cas	ting Processes; mold d	esign, die casting type	es, centrifugal casting,					
squeeze casting, vacuu	m molding, turbine blade	e casting methods.						
Casting Heat Treatmen	it							
Quality Assurance;								
Plaster mold casting	Q. 1'							
Process Automation Ca	ase Studies							
WELDING	C1							
Introduction to weiging	g; Classification, transfor	mation of an art to scien	ice.					
forge and diffusion we	tocesses; science of som	id state weiding, ultraso	onic, cold, inclion, not					
Liquid State Wolding	Drogosock Science of	liquid state welding n	rossess and walding					
thermite welding are y	velding (Arc welding pr	nquiù state welung p	physics of arc welding					
applications, newer arc etc.), resistance welding	welding processes viz. I ng, induction welding, la	Plasma – MIG Welding aser welding electron b	g, Twisted Arc Welding beam welding and their					
applications.		11 · 1 1·						
applications. Solid/Liquid State Wel	ding: Soldering brazing	adhesive bonding						

Solid/Liquid State Welding; Soldering, brazing, adhesive bonding. Weldability tests. Quality Assurance, Sensors and controls in welding.

- 1. Nomura, H. "Sensors and Control Systems in Arc Welding". Japan, Chapman & Hall
- 2. Welding Handbook, 8th edition, Vol. 1 5. AWS American Welding Society Publications
- 3. ASM Handbook Volume 06: "Welding, Brazing, and Soldering Hardbound"; Publisher: ASM; Publication.
- 4. A. Ghosh and A. K. Mallik, "Manufacturing Analysis", East West Press Ltd. New Delhi.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PEC02	Theory of Plasticity	L-T-P:3-0-2	None
	and Metal Forming		

- Describe diverse metal working processes
- To select the relevant load to be applied drawing wires and tubes
- To select the relevant metal working process for the given application
- To impart knowledge about principles and criteria of yielding during forming of metals
- To impart knowledge of analysis of different bulk metal forming processes following different analysis approach
- To understand the process mechanics with role of different controlling process parameters

#### **COURSE CONTENT**

Mechanics of Solids: 3D-State of Stress; Mohr's Circle for 3D-stress; Stress and Strain Tensor; Hydrostatic and Deviatoric Components of Stress; Strain a Point; Mohr's Circle of Strain; Elastic Stress-Strain Relations; Strain Energy; Isotropy and Anisotropy.

Theory of Plasticity: Strain-hardening; Bauschinger Effect; Flow Rules; True Stress and Strain; Yield Criteria; Anisotropy in Yielding; Yield Locus; Yield Surface and Normality; Octahedral Shear Stress Strain; Invariants of Stress and Strain; Plastic Stress-Strain Relations Mechanics of Metal Working Processes:

Slab Method of Analysis;

Uniform Deformation Energy Method;

Limit Analysis (Upper Bound and Lower Bound Techniques);

Slip-Line Field Theory (Two-Dimensional Plastic Flow)

Analysis of Rolling; Forging; Drawing; Extrusion; Deep Drawing; and Bending Processes using these methods.

Fundamentals of Metal Forming Operations: Classification of Forming Processes; Operating Principles Different Forming Processes; Temperature in Forming Processes (Hot, Cold and Warm Working); Friction and Lubrication in Metal Forming; Strain-Rate Effects; Workability; Residual Stresses; Commonly Occurring Forming Defects in Different Forming Processes

Sheet Metal Working Operation: Spring-Back Effect; Shearing and Blanking; Bending; Stretch Forming, and Miscellaneous Sheet-Metal Forming Operations; Forming Limit Criteria; Advanced Topics in Metal Working

#### **SUGGESTED READINGS:**

- 1. G. E. Dieter, "Mechanical Metallurgy", McGraw Hill Book Co. London.
- 2. G. W. Rowe, "Elements of Metal Working Theory", Edward Arnold London.
- 3. B. Avitzur, "Metal Forming: Processes and Analysis", McGraw Hill Book Co. New York.
- 4. J. Chakrabarty, "Theory of Plasticity", McGraw Hill International.

5. A. Ghosh and A. K. Mallik, "Manufacturing Analysis", East West Press Ltd. New Delhi.

Course No	Title of the Course	Course Structure	Pre-Requisite
PEC03	Advanced	L-T-P:3-0-2	None
	Manufacturing		
	Processes		

- Identify the need and to examine different functional elements of various advanced manufacturing processes and to identify the typical applications theses modern manufacturing processes.
- Examine and evaluate the unconventional manufacturing methods and their classification to use to the right manufacturing method for the right product
- Formulate real production problems creatively, especially in design considerations like material selection and process identification which is very important in the designing of new components.
- Demonstrate the ability to collect data of a given process/system, interpret, analyse data and make some conclusions for the different applications in the industry using variety of modern manufacturing methods such as unconventional machining (EDM, ECM, ECDM, IBM, EBM, PAM etc), micro/nano finishing operations (MRF, AFF, MAF, MRAFF, MFP etc), micro casting, micro forming, additive manufacturing etc.
- Design a process for day to day changing need of market in terms of applications and huge material choices due to advancement in materials technology.

#### **COURSE CONTENT**

Need and Classification of Advanced Manufacturing Processes

Advanced or Unconventional Machining Processes: Mechanics, Mechanism and Modeling of Material Removal; Parametric Analysis; Machine Tools; Shape and Material Applications; and Limitations of Mechanical type (AJM, USM, WJM, AWJM, AFM);

Chemical type (CHM, PCM),

Electro Chemical Type (ECM, ESD, etc.), and Thermal type AMPs (EDM, LBM, EBM, PAM, IBM, etc.) Concept and Need of Hybrid Machining Processes: WEDM, Plasma MIG, ECDM, etc.

Advanced Welding Techniques: Twisted Arc Welding; Plasma-MIG Welding; Laser Beam Welding; Electron Beam Welding; Solid Phase Joining Processes

Manufacturing/Shaping and Fabrication Processes for Advanced Materials like Polymers, Ceramics, and Composites, etc.

- 1. A. Bhattacharyya, "New Technology", Institution of Engineers (India), Calcutta.
- 2. P. C. Pandey and H. S. Shan, "Modern Machining Methods", Tata McGraw Hill Publishing.
- 3. A. Ghosh and A. K. Mallik, "Manufacturing Analysis", East West Press Ltd. New Delhi.
- 4. G. F. Bennedict, "Non-Traditional Manufacturing Processes", Marcell Dekker Inc.
- 5. J. A. McGeugh, "Advanced Methods of Machining", Chapman and Hall Ltd. London.
- 6. P. K. Mishra, "Nonconvetional Machining", Narosa Publishing House, New Delhi.
- 7. V. K. Jain, "Advanced Machining Processes", Allied Publisher, Mumbai.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PEC04	Generative	L-T-P:3-0-2	None
	Manufacturing		
	Processes		

- Describe the current available rapid prototyping systems, their fundamental operating principles, and their characteristics.
- Describe complementary, secondary fabrication processes commonly used with the above rapid prototyping systems.

• Select the appropriate fabrication technology, or technologies, for a given prototyping task.

#### **COURSE CONTENT**

Overview of Rapid Prototyping - definitions, evolution

Processes, Principles, Materials, Resources

CAD for Rapid Prototyping

Case Studies - Building the Prototype

Description: The method of course delivery will be split into lectures and student presentations, with a series of projects in parallel. Everyone will get the opportunity to learn popular rapid prototyping technologies. This course will have a decision-based design / CAD basis, rather than a materials processing / physical prototyping basis. That is, the focus will be on the usage of RP technologies in product development, with an emphasis on their selection. The course will be structured into three modules:

Selection of RP technologies. First-cut attributes and scales for selecting an appropriate technology. Survey of RP technologies with some hands-on training. Short reports and presentations on individual surveys.

In-depth development of analytical &/or experimental models for RP technology. The analytical or experimental model should lead to at least one selection attribute and scale. Geometric modeling issues and methods for RP, highlighting the CAD-RP interface. Reports and presentations on development of attributes and scales for one RP technology.

Application of RP selection method in 3-week design project (groups of 3-4). RP case studies in industry. Reports and presentations.

#### **SUGGESTED READINGS:**

1. Marshall Burns, "Automated Fabrication: Improving Productivity in Manufacturing", Prentice Hall.

2. Jerome L. Johnson, "Principles of Computer Automated Fabrication", Palatino Press, Inc.

3. Lamont Wood, "Rapid Automated Prototyping: An Introduction", Industrial Press.

4. Paul F. Jacobs, "Rapid Prototyping and Manufacturing: Fundamentals of Stereo lithography", Society of Manufacturing Engineers.

5. Larry Binstock, "Rapid Prototyping Systems: Fast Track to Product Realization", Society of Manufacturing Engineers.

6. Detlef Kochan, "Solid Freeform Manufacturing", Elsevier Science Publisher.

7. Paul F. Jacobs, "Stereolithography and Other RP&M Technologies: From Rapid Prototyping to Rapid Tooling", Society of Manufacturing Engineers.

## **DETAILED SYLLABUS FOR DISCIPLINE CENTRIC ELECTIVES**

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED01	Operation Research	L-T-P:3-1-0	None
	and Production		
	Management		
COURSE OUTCOM	ES (COs)		
• To understand the firm.	role of operations mana	gement in the overall b	business strategy of the
• To understand the i of the firm.	nterdependence of the o	perating system with oth	her key functional areas
• To identify and ev	aluate the key factors a	nd the interdependence	of these factors in the
design of effective	operating systems.	1	
• To identify and eva	aluate a range of tools a	ppropriate for analysis of	of operating systems of
the firm.			
• To identify and ev context.	aluate comparative appr	coaches to operations m	anagement in a global
• To understand the	application of operation	ns management policies	and techniques to the
service sector as we	ell as manufacturing firm	IS.	1
<b>COURSE CONTENT</b>			
Brief Review of Line	ear Programming: Simp	lex Method; Big M N	Iethod; Transportation
Model; and Assignmen	t Model		
Advanced Topics in	Linear Programming	: Duality; Parametric	; Goal; and Integer
Programming			
Sequencing Model			
Dynamic Programming	g: Need; Approach; Sys	tem Reliability and Ap	plications of Dynamic
Programming			
Queuing Model			
Game Theory			
Simulation			
Replacement Models			
Technique of Project N	lanagement: PERT, CPN	/] Fannan af Dua la stian Gau	4
Production Managemen	nt: Concept, Definition,	Types of Production Sys	tems;
Demand Forecasting;	t I amonte		
Production Scheduling	. Layout,		
Inventory Control	,		
Tools and Techniques	of Modern Production M	anagement	

### **SUGGESTED READINGS:**

1. J. L. Riggs, "Production Systems: Planning", Analysis and Control", John Willey and Sons Inc.

2. E. S. Buffa, "Modern Production and Operations Management" Willey Eastern Limited.

3. R. Panneerselvam, "Production and Operations Management", Prentice Hall of India, New Delhi.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED02	Artificial Intelligence	L-T-P:3-1-0	None

- Understand the history, development and various applications of artificial intelligence;
- Familiarize with propositional and predicate logic and their roles in logic programming;
- Learn the knowledge representation and reasoning techniques in rule-based systems, casebased systems, and model-based systems;
- Appreciate how uncertainty is being tackled in the knowledge representation and reasoning process, in particular, techniques based on probability theory and possibility theory (fuzzy logic);
- Master the skills and techniques in machine learning, such as decision tree induction, artificial neural networks, and genetic algorithm;

#### **COURSE CONTENT**

Basic of artificial neural Networks, Activation & Synaptic Dynamics, Feed forward Neural Networks, Feed Back neural Networks, Neural Networks for linear & nonlinear Dynamic System, Modeling and control, Basics of Fuzzy logic export systems ,fuzzy sets & control theory, Fuzzy systems as inference engines, Fuzzy systems as function approximates, model based fuzzy control learning based fuzzy control classical fuzzy control problem inverted pendulum.

Fuzzy modeling & tracking control of nonlinear systems stability of fuzzy controllers examples of fuzzy control system Design, Neuro fuzzy systems.

- 1. Timothy Ross "Fuzzy Logic with Engineering Applications". MC Graw Hill.
- 2. B. Yegnanarayana, "Artifical Nearal Networks". P.H.I Private Limited
- 3. Danw. Pathersm "Artificial Intelligence & Expert Systems", Eastern Economy Edition

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	<b>Pre-Requisite</b>
PED03	Design of	L-T-P:3-1-0	None
	Experiments		

- Plan, design, and conduct experimental investigations efficiently and effectively.
- Understand strategy in planning and conducting experiments.
- Choose an appropriate experiment to evaluate a new product design or process improvement through experimentation strategy, data analysis, and interpretation of experimental results.

#### **COURSE CONTENT**

Objectives, principles, terminologies, guidelines, and applications of design of experiments. Completely randomized design. Randomized block design. Latin square design. Two level and three level full factorial designs. Fractional factorial designs. Robust design. Mixture experiments. Central composite and Box-Behnken designs. Response surface methodology. Multi-response optimization. Analysis of variance. Statistical test of hypothesis. Analysis of multiple linear regression. Use of statistical software packages.

#### **SUGGESTED READINGS:**

Montgomery, "Design and Analysis of Experiments", Wiley Publication.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	<b>Pre-Requisite</b>
PED04	Design of Facilities	L-T-P:3-1-0	None

- Introducing the overall facilities planning process
- Exposing product, process and schedule design and their effects on the facility layout
- Developing the systematic facility layout procedure.
- Introducing mathematical models if the facility location problem and their analysis
- Exposing storage and warehouse design and their effects on facility planning Assess the value of facility planning on the strategy of a firm.
- Understand product, process and schedule design and their interaction with facility planning
- Develop a systematic facility layout using mathematical models.

#### **COURSE CONTENT**

System approach for the planning and design of facilities, plant location factors and theories, location of plant operation locational dynamics, Transportation models in plant location, Types of layout, Quantitative approaches to plant layout, computerized layout- planning, CRAFT, CORELAP, ALDEP. Analysis of material handling problems, selection of materials handling equipments automated warehousing and comeyorized systems. Assembly line balancing, plant maintenance, optimal maintenance policies, manpower planning and scheduling for maintenance, recent advancements.

- 1. Tompkins, "Facilities Planning", Wiley Publications.
- 2. Buffa, "Modern Production/Operations Management", Wiley Publication.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED05	Design of	L-T-P:3-1-0	None
	Management and		
	Information System		

- Knowledge and understanding of Information, strategy and customer-facing design theories which are relevant to the adoption and use of management information systems for competitive advantage
- Be able to reflect on the importance of customer centered information systems design on organizational effectiveness and global, competitive strategy
- Personal effectiveness to balance time/resources to deliver a range of formally and informally assessed outcomes, such as case analyses and presentations, class and tutorial discussions and overall attendance
- Be able to reflect on, analyse, and interpret information on contemporary IS management issues

#### **COURSE CONTENT**

Concepts is MIS, Role of information is decision making, characteristics of good MIS objectives of MIS, Reliability and availability of information on quality of decision making, Decision making without information (under uncertainty), Information kinds for various kinds of management, formal and informal information system, Distinction between physical system and information system, Information flow periodicity, forms and storage, Basic steps is determining the information cost. Frequency and form of information flow, computer purchases for various functional areas, selective information management, and information in MIS design. E.R.P, M.R.P., S.R.S., S.D.D., MIS for financial system, Inventory Management, Relative software platforms like DOT NET technology, data mining softwares.

- 1. Laudon, Kenneth C., and Laudon, Jane P., "Management Information Systems-Managing Digital Firm", Prentice Hall.
- 2. S. Sadagopan "management information systems" PHI learning
- 3. Hans van der Heijden, "Designing Management Information Systems", oxford university press.

Course No	Title of the Course	<b>Course Structure</b>	<b>Pre-Requisite</b>
PED06	Financial	L-T-P:3-1-0	None
	Management		

- Financial management provides a foundation of the main topics in financial economics covering selected topics in corporate finance and asset pricing.
- In corporate finance we will be discussing capital budgeting, valuation, capital structure, and payout policy.
- In asset pricing we will be studying the risk and return tradeoff, the Capital Asset Pricing Model, market efficiency, and derivative securities.
- To give everybody a base level of finance knowledge that an MPA from a top business school should possess,
- To give everybody the ability and confidence to tackle common financial problems in practice,
- To provide adequate preparation for future finance classes, especially the advanced corporate and investment classes at the McCombs School of Business

#### COURSE CONTENT

Introduction, factors affecting the growth of financial engineering, price volatility, liquidity needs, cash flow, time value, sensitivity analysis of time value, risk and return, managing risks, credit policy, asset management. Fixed assets and depreciation, analysis, and interpretation of financial statements, cash management, sources of funds for working capital, cost accumulation systems, budgeting, standard budgeting and control. Use of software like mat lab, dot net, data mining softwares.

#### **SUGGESTED READINGS:**

1. Khan, M.Y. and P.K. Jain, "Financial Management: Text and Problems" Tata McGraw Hill.

2. Srivastava, Rajiv, and Anil Mishra, "Financial Management" Oxford University Press.

3. Chandra, P. "Financial Management-Theory and Practice" Tata McGraw Hill.

4. Horne, Van; James C., John Wachowicz, "Fundamentals of Financial Management" Pearson Education.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	<b>Pre-Requisite</b>
PED07	Works Study and	L-T-P:3-1-0	None
	Ergonomics		

- Identify, explain and evaluate the impact of various personal attributes (anatomical, physiological, anthropometric and psychological) on proper safe working practice;
- Assess the effect of physical environment factors on comfort and performance;
- Apply principles of good ergonomic design of work areas and equipment to a range of occupational settings;
- Explain the influence of ergonomic principles on work organization and culture.

#### **COURSE CONTENT**

Introduction, Measurement of productivity, Method study, principles of motion economy, Macro motions analysis, work measurement, Time study, performance rating, standard allowances, work sampling, PMT MTM standard data system.

Ergonomics: Man machine system, types of displays, autodoxy presentation of information and speech communication Man-machine dynamics, Design of control, layout of workplace environmental effects and anthropometry.

- 1. O.P Khanna, "Work Study: Motion & Time Study, Dhanpat Rai Publication.
- 2. Barnes, "Motion and Time Study Design and Measurement of Work", Wiley Publication.
- 3. S. Dalela,"Text Book of Work Study and Ergonomics", Standard Publishers.
- 4. Lakhwinder Pal singh, "Work study and Ergonomics" Combridge university press.

<b>Course No</b>	<b>Title of the Course</b>	<b>Course Structure</b>	Pre-Requisite
PED08	Reliability	L-T-P:3-1-0	None
	Engineering		

- Understand the basic concepts of quality, reliability & safety.
- Compute measures of reliability of products and systems.
- Analyze failure data I Perform a Failure Modes, Effects and Criticality Analysis.
- Conduct a Fault Tree Analysis.
- Construct and analyze reliability block diagrams.
- Identify component importance.

Use redundancy to achieve reliability

#### **COURSE CONTENT**

Introduction, failure data analysis, MTTF, MTBF, Hazard models, series, parallel and mixed configuration, reliability improvement, reliability allocation, maintainability and availability, reliability based design, maintenance policies.

Reliability testing: Burn in testing, Binomial Testing, Acceptance testing, Accelerated life Testing, Degradation Models.

Reliability Improvement: Reliability specification and system measurements, System effectiveness, Economic analysis and life cycle cost, Reliability allocation (AGREE method, Redundancies).

Reliability Design Methods: Parts and material selection, De-rating, Stress-Strength analysis, Complexity and Technology, Redundancy.

Maintenances systems and economics of reliability.

- 1. ADS Carter, "Mechanical Reliability Engineering", Mc Milan.
- 2. Roy Bilington and R. N. Allen, "Reliability Evaluation of Engineering Systems, Pitman.
- 3. Balagurusamy.E., "Reliability Engineering", Tata McGraw Hill Publishing Company.

<b>Course No</b>	<b>Title of the Course</b>	<b>Course Structure</b>	Pre-Requisite
PED09	Computational	L-T-P:3-1-0	None
	Methods		

At the end of the Course, Student will be able to

- Discuss several important methods with widespread application for solving large system of equations
- Appraise the importance of Eigen value problems in engineering sciences.
- Analyze experimental data by fitting a polynomial or estimating the derivative or finding the integrals or performing Fourier analysis.
- Prepare mathematical model for physical situations and numerically analyze the corresponding ordinary linear/nonlinear, initial/boundary value differential equations.
- Prepare mathematical model for physical situations and numerically analyze the corresponding partial linear/nonlinear, initial value/ initial boundary value differential equations.

#### **COURSE CONTENT**

Errors in numerical calculations and series approximations, Solution of algebraic and transcendental equations, Interpolation of data, finite differences, Curve fitting, Numerical differentiation and integration, Matrices and linear system of equations, Numerical solution of ordinary differential and partial differential equations, Solution of integral equations, Numerical solution of important production engineering problems.

- 1. Steven C. Chapra and Raymond P Canale "Numerical Methods for Engineers"
- 2. T.R. McCalla "Introduction to Numerical Methods and Fortran Programming"
- 3. S.P. Venkateshan and Prasanna Swaminathan "Computational Methods in Engineering" Elsevier Inc.
- 4. M. Kleiber; E. Oñate, "Archives of Computational Methods in Engineering" Springer.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	<b>Pre-Requisite</b>	
PED10	Optimization	L-T-P:3-1-0	None	
	Techniques			

- Identify necessity and development of mathematical models for various industries.
- Describe basic optimization and simulation techniques applied to various industries.
- Predict the industrial systems under the conditions of certainty, uncertainty and risk.
- Propose a queuing model based upon given data.
- Derive the network models and understanding of reliability concept.
- Demonstrate cost effective strategies in various applications in industry.
- Explain the importance and phases of Operation Research.
- Form the Linear programming model and solve it by graphical method and simplex algorithms.
- Recognize the balanced and unbalanced transportation models and predict optimum solution by MODI method.
- Outline and solve the shortest route, minimal spanning tree and maximal flow network problems.
- Construct the CPM and PERT networks.

#### **COURSE CONTENT**

Introduction: historical development, engineering applications; statement of problem-objective function, constraints, classification, techniques. Single variable optimization, multivariable optimization with equality and inequality constraints.

Linear programming: Formulations of linear programs, graphical method, simplex method, simplex algorithm, sensitivity analysis. Duality, decomposition principle.

Mathematical statement of transportation problem, methods of finding Basic Feasible Solution, test of optimality, MODI'S method for optimal solution, variation in transportation problem. Network Analysis: Project planning and control with PERT-CPM.

Decision analysis: decision under certainty, risk probability and uncertainty; AHP- assigning weight and consistency test of AHP. Meta-heuristics: Definition of heuristic and meta-heuristic algorithms; introduction to Tabu search, Simulated Annealing and Genetic algorithms.

#### **SUGGESTED READINGS:**

1. Hillier FS and Liberman GJ; "Introduction to Operations Research concept and cases"; TMH

- 2. Taha H; "Operations research"; PHI
- 3. Sen RP; Operations Research-Algorithms and Applications; PHI Learning
| <b>Course No</b> | <b>Title of the Course</b> | <b>Course Structure</b> | Pre-Requisite |
|------------------|----------------------------|-------------------------|---------------|
| PED11            | IT in Manufacturing        | L-T-P:3-1-0             | None          |
|                  | Enterprises                |                         |               |

- To be able to application of ERP systems in Manufacturing sector
- To be able to understand information technology systems in manufacturing enterprise

#### **COURSE CONTENT**

Production Systems, Manufacturing Enterprises as Systems, Appreciate the evolving manufacturing environment and multi-attributed competition; IT role Challenges and Opportunities, Evolving Role of information Technology in Enterprises; P&I Implications, Technology Management Challenges, Technical Fundamentals; MIS in Manufacturing Enterprises, FMS (Flexible manufacturing Systems), CIM Systems, Intelligent Manufacturing Systems, Concurrent Engineering and Extended Enterprises, ERP (Enterprise Resource Planning), E-Business and supply Chain Management, Discrete Event Simulation and AI Applications in manufacturing enterprises, Implementation Issues, Future Treands Careers etc, use of software like DOT NET, DATA MINING etc..

#### **SUGGESTED READINGS:**

1. Luca G. Sartori, "Manufacturing Information Systems ", Addison-Wesley Publishing Company.

2. Date.C.J., "An Introduction to Database systems ", Narosa Publishing House.

3. Orlicky.G., "Material Requirements Planning ", McGraw-Hill Publishing Co.

4. Kerr.R, "Knowledge based Manufacturing Management ", Addison-wesley.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED12	Value Engineering	L-T-P:3-1-0	None

- Understand the basics of Value Engineering (VE) to ensure that a standardized method is used for VE applications to projects
- Learn to perform "function analysis" for buildings and civil projects
- Understand the appropriate time to apply VE for building design projects
- Gain an understanding of the total decision-making methodology of value engineering
- Learn of the "SAVE International Value Methodology Standard" and the convention to be followed for application of VE to projects
- Acquire the necessary information on VE to recognize the benefits resulting from their adoption as a standard practice within an organization
- Be able to engage clients in a meaningful discussion on VE as well as demonstrate a commitment to optimize the value for facilities

## **COURSE CONTENT**

Introduction to Value Engineering (V.E.) and Value Analysis, Life Cycle of a Product, Methodology of V.E., Quantitative definition of Value, Use Value and Prestige Value, Estimation of product quality performance

Types of Functions, Relationship between Use Functions and Esteem Functions in product design, Functional Cost and Functional Worth, Effect of value improvement on profitability, Aims of VE systematic Approach.

Introduction to V.E. Job plan / Functional Approach to Value Improvement, Various phases and techniques of the job plan, Factors governing project selection, Life Cycle Costing for managing the Total Value, Concepts in LCC, Present Value concept, Annuity concept, Net

Present Value, Pay Back period, Internal rate of return on investment (IRR), Examples and illustrations.

Creative thinking and creative judgment, False material, labor and overhead saving, System Reliability, Reliability elements in series and parallel, Decision matrix, Estimation of weights and efficiencies, Sensitivity analysis, Utility functions, Fast diagramming, Critical path of functions.

## **SUGGESTED READINGS:**

- 1. S.S. Iyer, "Value Engineering", New Age International, New Delhi.
- 2. Miles, Lawrence D., "Technology of Value Analysis And Engineering", McGraw Hill.
- 3. Mudge Arthur E., "Value Engineering: Systematic Approach", Mcgraw Hill, New York.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED13	Supply Chain	L-T-P:3-1-0	None
	Management and		
	Logistics		

- Supply chain management consist of all parties (including manufacturer, marketer, suppliers, transporters, warehouses, retailers and even customers) directly or indirectly involved in fulfillment of a customer.
- The main objective is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for a business firm.

## COURSE CONTENT Unit I

**Introduction:** Concept of supply chain management (SCM) and trade logistics; Scope of logistics; Logistic activities – an Overview; Contribution of logistics at macro and micro levels; SCM and trade logistics; Business view of SCM; Concept, span and process of integrated SCM; Demand management – methods of forecasting; Supply chain metrics (KPIs), performance measurement and continuous improvement; Product development Process and SCM; Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle.

Unit II

**Managing Relationship:** Role of Relationship marketing in SCM; Managing relationships with suppliers and customers; Captive buyers and suppliers; Strategic partnerships; Supplier-retailer collaboration and alliances.

Unit III

**Focus Areas of Logistics and Supply Chain management:** Transportation-Importance of effective transportation system; Service choices and their characteristics; inter-modal services; Transport cost characteristics and rate fixation; In-company management vs. out-sourcing; World sea borne trade; International shipping- characteristics and structure; Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Development in sea transportation-Unitization, containerisation, inter and multimodal transport; CFC and ICD. Air transport: Set up for air transport and freight rates; Carriage of Goods by sea -Role and types of cargo intermediaries. Warehousing and inventory management: Reasons for warehousing; Warehousing evaluation and requirements; Warehousing location strategies; Inventory management principles and approaches; Inventory categories -EOQ, LT, ICC **Unit IV** 

**IT Enabling Logistics and Supply Chain:** Technology in logistics – EDI, bar Coding, RFID etc., data warehousing, electronic payment transfers; Business management systems; TRADITIONAL ERP, SPECIAL ERP, MR, DRP, PDM, EIP, CPFR, WMS, TMS; Reengineering the supply chain- Future directions. **Unit V** 

**Trends and Challenges in logistics and supply chain management:** Third party logistic outsourcing –challenges and future directions.

# **SUGGESTED READINGS:**

1. Christopher, M., "Logistics and Supply Chain Management", Prentice Hall.

2. Handfield and Nicholas, Jr., "Introduction to Supply Chain Management", Prentice Hall.

3. Jhon J Coyle, C. JhonandLangley,Brian J Gibs, "Logistics approach to Supply Chain Management", Cengage Learning.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED14	Maintenance	L-T-P:3-1-0	None
	Management		

- Describe modern maintenance practices and their integration within the production organization.
- Explain the roles of management and planning in maintenance.
- Evaluate and apply modern maintenance practices to mine production operations.

#### COURSE CONTENT

Introduction to maintenance management, Reliability basics, Asset criticality Analysis, Reliability centered maintenance, Basic maintenance models for age and time based replacement, block and group replacement, inspection and shock based replacement, imperfect maintenance models, Maintainability models, Availability models, Life cycle cost models, Simulation based approach for maintenance planning, Queuing models for maintenance planning, Models for condition monitoring, Models for Maintenance scheduling, Maintenance performance measurement, Asset management practices, Case studies.

#### **SUGGESTED READINGS:**

Mohamed Ben-Daya, Uday Kumar, D. N. Prabhakar Murthy Introduction to Maintenance Engineering: Modelling, Optimization and Management, Wiley.

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED15	Design of	L-T-P:3-1-0	None
	Manufacture		

- Perform the essential stages of a Design for Manufacture process.
- Recognize and list the benefits of the DFM/DFA method in creating product designs which support manufacturing processes and cost reduction.
- Outline a Robust Manufacturing Plan that optimizes and simplifies product design without sacrificing quality.
- Objectively determine which designs would be suitable as DFM/DFA candidates.
- Construct an actual DFM/DFA worksheet and calculate design efficiency using an instructor provided project.

## **COURSE CONTENT**

## 1. INTRODUCTION

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits – Datum features - Tolerance stacks.

## 2. FACTORS INFLUENCING FORM DESIGN

Working principle, Material, Manufacture, Design - Possible solutions - Materials choice - Influence of materials on from design - from design of welded members, forgings and castings.

## 3. COMPONENT DESIGN-MACHINING CONSIDERATION

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area - simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

## 4. COMPONENT DESIGN - CASTING CONSIDERATIONS

Redesign of castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

5. REDESIGN FOR MANUFACTURE AND CASE STUDIES

Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

## **SUGGESTED READINGS:**

1. Harry Peck, "Design for Manufacture", Pittman Publication.

- 2. Robert Matousek, "Engineering Design A systematic approach", Blackie & sons Ltd.
- 3. James G. Bralla, "Hand Book of Product Design for Manufacturing", McGraw Hill Co.
- 4. Swift K.G., "Knowledge based design for manufacture, Kogan Page Ltd.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED31	Advanced	L-T-P:3-0-2	None
	Mathematics and		
	Numerical Analysis		

- To be able to expand functions in a Fourier series and apply Harmonic analysis to numerical data.
- To be able to evaluate Laplace transforms and inverse Laplace transform and apply Laplace transforms to solve ordinary differential equations.
- To be able to evaluate line, surface and volume integrals
- To be able to describe errors involved in computations and to estimate these errors.
- To be able to solve equations, apply numerical methods to interpolate, extrapolate, and differentiate and integrate functions.
- To be able to solve differential equation using numerical methods and solve system of equations.

#### **COURSE CONTENT**

Perturbation Method: Asymptotic Expansion, Method of steepest descent, Regular and singular perturbations, Method of strained Co-ordinates, Multiple scales, Matched asymptotic expansions.

Integral Transforms of Fourier, Laplace, Hankel and Mellin. Fredholm and Volterra Integral equations and the iterative solutions. Fredholm alternative, Symmetric Kernels and Singular Integral Equations.

Solution of a system of linear equations: Gaussian Elimination and Gauss-Seidel Methods.

Solution of Nonlinear equations: Bisection Method, Secant Method, Method of False Position, Newton-Raphson Method, Chebyschev Method, Rate of Convergence, System of nonlinear equations.

Interpolation by polynomials: Divided difference, Error of the interpolating polynomial, least square approximation, Piecewise linear and cubic spline interpolation.

Numerical Integration: Composite Rules, Gaussian Quadrature formula, Error formula.

Numerical solutions of differential equations: Euler and Runge-Kutta methods, Multistep methods, and Predictor - corrector Methods, Order of convergence.

## SUGGESTED READINGS:

- 1. S. D. Conte, Carl De Boor, "Elementary Numerical Analysis, An Algorithmic Approach", 3rd Ed. McGraw Hill.
- 2. C. E. Froberg, "Introduction to Numerical Analysis", 2<sup>nd</sup> Ed., Addision Wesley.
- 3. K. E. Atkinson, "An Introduction to Numerical Analysis", Wiley.
- 4. F. B. Hildebrand, "Introduction to Numerical Analysis", Tata McGraw-Hill.
- 5. I. N. Sneddon, "The use of Integral Transforms", Tata McGraw Hill.
- 6. S. G. Mikhlin, "Integral Equations", Pergamon Press.
- 7. A. C. Pipkin, "A Course on Integral Equations", Springer-Verlag,

Course No	Title of the Course	Course Structure	Pre-Requisite		
PED32	Robotics	L-T-P	None		
<b>COURSE OUTCOM</b>	ES (COs)				
Knowledge of basic	c components and config	uration of Robot.			
Knowledge of Stati	cs and Dynamics of Rob	ootics.			
• Knowledge of moti	on planning of robotics.				
• Knowledge of Conv system.	ventional Control algorit	hms of Robotics and nor	n-linear dynamic		
Knowledge of artifi	icial intelligent control al	lgorithms of Robotics.			
Knowledge of conc	epts of actuators and sen	sors used in Robots.			
Knowledge of Hard	lware and software aspec	ct of the Robot.			
• Design and fabricate working robotic systems in a group-based term project					
COURSE CONTENT					

Introduction, Applications, classification, Basic components of a robot system, Specifications, Robot Anatomy, Coordinate frames, mapping, and transforms, Euler angle axis representation, Direct kinematics model, Denavit Hartenberg notation, Inverse kinematics, Manipulator Differential Motion & statics, Dynamic modeling ,Lagrange -Euler formulation, Newton-Euler formulation, Inverse dynamics, Trajectory planning, control of Manipulators, PID control, computed torque control feed forward control, AI control, Sensors in Robotics, Robotic Vision, Robot Software & Programming, Robotic system overall Design.

#### **SUGGESTED READINGS:**

1. K.S Fu R.C. Gonzalez, C.S. G. Lee "Robotics control sensing vision and Intelligence": Mc Graw Hill Book Company,

- 2. Robert, J. Schilling, "Fundamentals of Robotics: Analysis & control" PHI Private Ltd.
- 3. Richard D. Klaffer "Robotic Engineering: An Integrated Approach", P.H.I Private Limited 4. TSUNEO Yoshikawa, "Foundations of Robotics: Analysis & Control", P.H.I. Private Limited

Satya Ranjan Deb "Robotics Technology and Flexible Automation", Tata MC-Graw Hill
 J. J. Craig Addison "Introduction to Robotics Mc Chanics & Control 2nd Edition", Wesley

<b>Course No</b>	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED03	Product Design and Manufacturing	L-T-P:3-0-2	None

- To introduce different design disciplines and various steps involved in a design process.
- To provide a detailed insight to students about engineering design and how it is different from other design disciplines.
- To introduce various types of mechanical elements like springs, bearings, shafts, brakes, clutches, gears etc. to the students and brief explanation about their manufacturing process.
- To introduce theories of failure, mechanical properties of material, stress-strain diagram for ductile and brittle materials.
- Introduction to dynamic stress, calculation of endurance limit.
- To develop an aptitude among the students that how different products and components that they see in their daily life can me manufactured and fabricated.
- To provide detailed introduction about different types of permanent and temporary fasteners and calculation of stresses using mathematical equations.
- To develop ability among students to use the knowledge of mathematics, mechanics of solids and other reengineering disciplines like Computer Aided Design and Finite Element Analysis in solving engineering problems and to have a better design aptitude.
- After the completion of the course students should develop a know-how that how different mechanical elements can be combined together to develop a simple machine.

#### COURSE CONTENT

Introduction, development processes and organizations, opportunity identification. Product planning. Identifying customer needs. Product specifications. Concept generation. Concept selection. Concept testing. Product architecture. Industrial design

Design for environment. Design for manufacturing. Prototyping. Robust design. Patents and intellectual property. Design of services. Product development economics. Managing projects.

## **SUGGESTED READINGS:**

Karl T. Ulrich and Steven D. Eppinger "Product Design and Development":, Sixth Edition, McGraw-Hill, New York.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED34	Computer Aided	L-T-P:3-0-2	None
	Manufacturing		
	(CAM)		

- Identify different axes, machine zero, home position, controls and features of CNC machines.
- Select, mount and set cutting tools and tool holders on CNC.
- Prepare part programmes using ISO format for given simple components with and without use of MACRO, CANNED CYCLE and SUBROUTINE using ISO format.
- Interface software application for auto part programming.

## **COURSE CONTENT**

Unit – I. Fundamentals of CAM.

1.1 CAM - concept and definition. 1.2 NC (Numerical Control), CNC (Computerized Numerical Control) and DNC (Direct Numerical Control) - concept, features and differences.1.3 Advantages and limitations of CNC. 1.4 Selection criteria for CNC machines.

Unit- II Constructional features of CNC machines.

2.1 CNC machines: Types, classification, working and constructional features. 2.2 Spindle drives and axes drives on CNC machines. 2.3 Machine structure- Requirements and reasons. 2.4 Elements of CNC machines - Types, sketch, working and importance of: i. Slide ways. ii. Re-circulating ball screw. iii. Feedback devices (transducers, encoders). iv. Automatic tool changer (ATC). v. Automatic pallet changer (APC). 2.5 CNC axes and motion nomenclature. 2.6 CNC tooling: i. Tool presetting-concept and importance. ii. Qualified tools-definition need and advantages. iii. Tool holders- types and applications.

Unit – III CNC Turning & Machining Centers.

3.1 CNC turning centres: i. Types. ii. Features. iii. Axes nomenclature. iv. Specification. v. Work holding devices -types, working and applications. vi. Tool holding and changing devices - types, working and applications. 3.2 CNC machining centres: i. Types. ii. Features. iii. Axes nomenclature. iv. Specification. v. Work holding devices-types, working and applications. vi. Tool holding and changing device types, working and applications

Unit – IV CNC part programming.

4.1 Definition and importance of various positions like machine zero, home position, work piece zero and programme zero. 4.2 CNC part programming: programming format and structure of part programme. 4.3 ISO G and M codes for turning and milling-meaning and applications of important codes. 4.4 Simple part programming for turning using ISO format having straight turning, taper turning (linear interpolation) and convex/concave turning (circular interpolation). 4.5 Simple part programming for milling using ISO format. 4.6 Importance, types, applications and format for: i. Canned cycles. ii. Macro. iii. Do loops. iv. Subroutine. 4.7 CNC turning and milling part programming using canned cycles, Do loops and

Subroutine. 4.8 Need and importance of various compensations: i. Tool length compensation. ii. Pitch error compensation. iii. Tool radius compensation. iv. Tool offset. 4.9 Simple part programming using various compensations.

Unit – V Recent trends in CAM.

5.1 Interfacing standards for CAD/CAM - Types and applications 5.2 Adaptive controldefinition, meaning, block diagram, sources of variability and applications. 5.3 Flexible Manufacturing System (FMS) - concept, evaluation, main elements and their functions, layout and its importance, applications. 5.4 Computer Integrated Manufacturing (CIM) - Concept, definition, areas covered, benefits. 5.5 Robotics- definition, terminology, classification and types, elements and applications. 5.6 Rapid prototyping - Concept and application

#### **SUGGESTED READINGS:**

- 1. Rao P N, Tiwari N K, Kundra T, "Computer Aided Manufacturing" Tata McGraw Hill.
- 2. Groover Mikell P, Zimmered W Emory ,"CAD/CAM: computer aided design and manufacturing". Prentice Hall.
- 3. Quesada Robert , "Computer Numerical Control Turning and Machining centers".. Prentice Hall.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED35	Metrology	L-T-P:3-0-2	None

- Student learns the importance of different types of measurements, measuring instruments and measuring techniques.
- Student will be able to relate the ideas conveyed, to the industrial applications.
- Student learns about vast variety of measuring instruments available along with their right usage point.
- Student learns about the design aspects of gauges, their tolerances and selection.
- Student can maturely utilize the knowledge gained in solving quality related issues.
- Student learns about the various quality control techniques prevalent in industry along with their applications
- Student understands the basic concepts of quality, its cost and value of quality, standardization.
- Student learns the importance of quality certifications and the awarding agencies involved.
- Student learns the role and importance of computer in controlling the quality related issues.

#### **COURSE CONTENT**

Introduction to Dimensional Metrology, standardization, interchangeability, selective assembly, Indian standard specifications, application of tolerances, Limit gauging-Taylor's principles of limit gauging, Design of Gauges, Inspection by measurement; interferometers. GD&T, Applications of Dimensional Inspection, Inspection of Surface Quality, Feature inspection- straightness, flatness, parallelism, squareness, circularity and roundness. Automated Dimensional Measurements: Introduction, Automatic Gauging, Automatic Measuring Machines for inspecting multiple workpiece dimensions, Automatic Gauging Machine Part-Matching Functions, Coordinate Measuring Machines-Types, Probes, Accessories, Measurement, Computer supported Coordinate Measurements.

#### **SUGGESTED READINGS:**

1. Bewoor, "Metrology and Measurement" Tata McGraw-Hill Education.

2. A.M.Badadhe, "Metrology And Quality Control" Technical Publications.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite	
PED36	Finite Element	L-T-P:3-0-2	None	
	Methods			
COURSE OUTCOM	ES (COs)			
• Students to under	stand the basics of fin	ite element analysis a	nd its applications in	
engineering with or	ne, two and three dimens	ional elements.		
• To provide the func	lamental concepts of the	theory of the finite elem	ent method	
• To obtain an unders	standing of the fundamer	ntal theory of the FEA m	ethod;	
• To develop the abil	ity to generate the govern	ning FE equations for sy	stems governed by	
partial differential e	equations;			
• To understand the u	use of the basic finite elements	ments for structural appl	ications using truss,	
beam, frame, and p	lane elements; and			
• To understand the a	application and use of the	FE method for heat trai	nsfer problems.	
COURSE CONTENT				
Discretization and the l	Direct Stiffness Method			
Basic concepts of struc	tural modeling			
Review of the stiffness	method of structural ana	llysis.		
Modeling stiffness, loa	ds and displacement bou	ndary conditions.		
Advanced modeling: go	eneral constraints, substr	ucturing.		
Formulation of Finite E	Elements			
Mathematical interpret	ation of finite elements,	vibrational formulation.		
Development of contin	uum elements, shape fun	ctions, consistent loads.		
Isoperimetric elements	for plane stress.			
Numerical integration				
Convergence requireme	ents.	t Mathad		
Drangagaging: model d	loli of the finite Elemen	t Method		
Flement level coloulati				
Equation assembly	0115.			
Equation solver				
Equation solver. Post processing: strain and stress recovery				
SUCCESTED READINCS.				
1. Rao. S.S. `The Finit	e element method in Eng	vineering', II Ed., Pergan	non Press, Oxford	
2 K I Bathe `Finite element procedures in Engineering Analysis" Prentice hall Engle Wood				
chiffs.	procedures in En	<u> </u>		
3 C.S. Desai and J.P. Abel "Introduction to finite element method" Affiliated East West				
Press,				
4. Besant, `Finite Elen	nent Method', Prentice H	all, II Ed.		

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED37	Automation in	L-T-P:3-0-2	None
	Manufacturing		

- Become familiar with the different types automation and study both technological and economic issues involved in automatic manufacturing of products.
- Develop an understanding of programmable or flexible manufacturing and its suitability for various manufacturing environments.
- Learn about the modern techniques and devices used for the monitoring and control of manufacturing systems including programming of programmable logic controllers and their interfacing with various sensors and actuators.
- Understand the major components of mechatronic systems used in automation such as commonly used sensors and common techniques for sensor interfacing and protection circuits.
- Understand industrial control logic design using ladder diagram and programmable logic controller.

#### **COURSE CONTENT**

Introduction to Automation of different manufacturing processes. Types of systems - mechanical, electrical, electronics; Data conversion devices, transducers, signal processing devices, relays, contactors and timers. Sensors and their interfaces;

Hydraulics & Pneumatic Systems design and their application to manufacturing equipment; Sequence operation of hydraulic and pneumatic cylinders and motors; Electro Pneumatic & Electro Hydraulic Systems design, Relay Logic circuits, Feedback control systems, PID Controller; Drives and mechanisms of an automated system: stepper motors, servo drives. Ball screws, linear motion bearings, electronic caming and gearing, indexing mechanisms, tool magazines, and transfer systems. Programmable Logic Controllers, I/Os, system interfacing, ladder logic, functional blocks, structured text, and applications. Human Machine Interface & SCADA; Motion controller and their programming, PLC Open Motion Control blocks, multi axes coordinated motion, CNC control; RFID technology and its application; Machine vision and control applications. Modular Production Systems – Distribution, Conveying, Pick & Place etc.

Laboratory work will be hands-on design and operation of automatic systems.

## **SUGGESTED READINGS:**

S. K. Taneja and S. P. Rana, "Automation in Manufacturing", Springer.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED38	Flexible	L-T-P:3-0-2	None
	Manufacturing		
	Systems		

- Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems
- Explain processing stations and material handling systems used in FMS environments.
- Design and analyze FMS using simulation and analytical techniques.
- Understand tool management in FMS
- Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

#### **COURSE CONTENT**

Introduction to FMS: Definition of FMS – types and configuration concepts – types of flexibility and performance measures. Functions of FMS host computer – FMS host and area controller function distribution.

Development and implementation of FMS: Planning phases – integration – system configuration – FMS layouts – simulation – FMS project development steps. Project management – equipment development – host system development – planning - hardware and software development.

Distributed numerical control: DNC system – communication between DNC computer and machine control unit – hierarchical processing of data in DNC system – features of DNC system.

Automated material handling: Function - types – analysis of material handling equipment's. Design of conveyor and AGV systems.

Automated storage: Storage system performance -AS/RS - carousel storage system - WIP storage - interfacing handling storage with manufacturing.

Programmable logic controllers: Components of the PLC – PLC operating cycle – additional capabilities of a PLC – programming the PLC - Ladder logic diagrams, counters etc–Industrial process control using PLC.

FMS rationale: Economic and technological justification for FMS – GT, JIT – operation and evaluation – personnel and infra structural aspects – typical case studies – future prospects.

#### **SUGGESTED READINGS:**

1. Parrish D. J, "Flexible manufacturing", Butterworth – Heinemann Ltd.

2. Groover M. P, "Automation, production systems and computer integrated manufacturing", Prentice Hall India (P) Ltd.

3. Kusiak A., "Intelligent manufacturing systems", Prentice Hall, Englewood Cliffs, NJ.

4. Considine D. M. & Considine G. D, "Standard handbook of industrial automation", Chapman and Hall, London.

5. Ranky P. G, "The design and operation of FMS", IFS Pub, U. K.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED39	Design of Machine	L-T-P:3-0-2	None
	Tools and Cutting		
	Tools		

- To be able to explain requirements of machine tools.
- To be able to understand analysis of machine tools structures like strength, rigidity.
- To be able to understand functional analysis of guides and sideways.

#### **COURSE CONTENT**

Basic Concept and General Requirements of Machine Tools

Analysis of Machine Tools from Different Point of View: Kinematic, Strength, Rigidity, Dynamic, Fatigue, Wear, Reliability, Economy

Drives: Design and Analysis of Belt, Gear, and Hydraulic Drives

Bearing Design and Selection

Functional Analysis of Guides and Slide ways

Static and Dynamic Analysis of Machine Tools

Control and Automation of Machine Tools

Cutting Tool Design: General Considerations; Methods and Procedures of Tool Cutting Design; Tool Making Practices; Cutting Tool Designation; Design of Single Point and Multi Point Cutting Tools.

#### **SUGGESTED READINGS:**

1. N. K. Mehta, "Machine Tool Design and Numerical Control", Tata McGraw Hill Publishing Co. Ltd. New Delhi.

2. G. C. Sen and A. Bhattacharyya, "Principles of Machine Tools: Vol.2 Design and Construction of Machine Tools", New Central Book Agency, Calcutta.

3. G. Boothryod, "Fundamentals of Metal Machining and Machine Tools" Marcel Dekker.

4. B. L. Juneja and G. S. Shekhon, "Fundamentals of Metal Cutting and Machine Tools", Wiley Eastern, New Delhi.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite	
PED40	Mechatronics	L-T-P:3-0-2	None	
COURSE OUTCOM	ES (COs)			
• Understand the med	chanisms of commonly u	used actuators and how t	to select a proper set of	
sensors and actuato	rs for a practical mechati	ronic system.		
Identification of ke	ey elements of mechatro	onics system and its rep	resentation in terms of	
block diagram				
• Understanding the	concept of signal proce	essing and use of interf	acing systems such as	
ADC, DAC, digital	I/O			
Development of PL	C ladder programming a	and implementation of re	al life system	
• Explain the concept	ts of mechatronic system	ns, adoptive control, man	-machine interface and	
mechatronic design		-		
• Summaries the cond	cepts of mechanical and	electronic actuation syst	ems.	
• Explain the working	g of stepper and servo m	otors.		
• Write the program	me for programmable	logic controllers and d	iscuss case studies of	
mechatronic system		logie controllers and a		
• The students will b	e able to feel the import	ance of this subject as r	nechanical engineering	
students They will	be able to understand t	he need of the subject f	For industries. To some	
extent they will be	able to design the basic of	vircuit of a mechatronic s	avetem	
COURSE CONTENT	uble to design the busic c		<i>y</i> stem.	
Introduction to Mech	atronics. Hvdraulic a	nd Pneumatic actuator	systems, operational	
characteristics and perf	formance of hydraulic ba	sed actuation systems ir	cluding linear devices,	
rotary devices, flow control valves, pressure control valves, I-P and P-I converters ancillary				
devices (accumulator, a	amplifiers etc.)			
Electrical actuation sys	tems: Operational chara	acteristic and application	n of electrical actuation	
components for appli	cation like, AC/DC m	otors, stepper motors,	relays, push buttons,	
switches, etc.				
programming of PLC	programmable Logic Controllers and applications: PLC structures, PLC languages,			
PLC. Some case Studies like auto focus camera, printer, programming washing machine,				
optical mar reader (OMR) etc.				
SUGGESTED READINGS:				
1. Lawrence J.Kamm,	1. Lawrence J.Kamm, " Understanding Electro-Mechanical Engineering, An Introduction to			
Mechatronics ", Pre	entice-Hall	•		
2. Michael B.Histand	d and David G. Alc	chatore, "Introduction	to Mechatronics and	
2. Michael B.Histand Measurement Syste	entice-Hall d and David G. Alc ems", McGraw-Hill Inter	ciatore, "Introduction national Editions	to Mechatronics and	

<b>Course No</b>	<b>Title of the Course</b>	<b>Course Structure</b>	<b>Pre-Requisite</b>
PED41	CAD and Geometric	L-T-P:3-0-2	None
	Modeling		

- Create, annotate, edit and plot drawings using basic AutoCAD commands and features.
- Apply basic Auto CAD skills to intermediate AutoCAD course and other design and drafting courses.
- Create part drawing and their assembled views for different machine parts in 2-D.
- Create part drawing and their assembled views for different machine parts in 3-D.

#### **COURSE CONTENT**

1. Unit I General

Introduction to CAD, Fundamentals of Computer Hardware- interactive graphic display-Graphic systems. Display devices- Hard copy devices- interactive graphic input & output devices display processors.

Unit II Graphic Primitive

Scan conversion, output primitive-point plotting techniques co-ordinate systems, increment methods. Line-drawing algorithms. Circle generating algorithms. Programming using C/Auto Lisp to generate various primitives. Color representation.

2. Unit III 2D & 3D Transformation

Translation, scaling rotation- matrix representations and Homogeneous co-ordinates.

Composite transformations (concatenation) Concatenation properties. General transformation equations. Windowing and clipping line-clipping midpoint sub division, clipping other graphic entities, polygon clipping viewing and windowing transformation

Writing interactive programs using C/AutoLisp for transformations. Perspective projection, techniques for visual realism- hidden line- surface removal. Algorithms for shading and Rendering. Concepts of Animation and Virtual reality.

3. Unit IV Curves, Surfaces, Solids

Representation of curves- Bezier curves- cubic spline curve B- Spline curves Rational curves-Surfaces modeling techniques-surface patch. Coons patch bi-cubic patch- Bezier and B- spline surfaces- Volume modelling Techniques- Boundary models- CSG, Feature Based Modeling-Parametric Modeling- Variational Modeling. Creation of parts using software packages2D Representation- Development of surfaces using C/AutoLisp.

Unit IV Graphics Standards for CAD.

Need of Graphics and computer standards, Open Architecture in CAD- Open GL, data exchange standards-STL - IGES-STEP-CALS-DXF- Communication standards. Application of Object broker Architecture in CAD/CAM data transfer.

4. Unit V Reverse Engineering

Introduction to reverse engineering

## **SUGGESTED READINGS:**

- 1. IBRAHIM ZEID " CAD/CAM- Theory and Practice" McGraw Hill, International Edition.
- 2. Chris Mc Mohan and Jimmi Browne, "CAD/CAM Principles, practice and manufacturing management", Pearson Education Asia Ltd.
- 3. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall. Inc.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED42	Computer	L-T-P:3-0-2	None
	Programming and		
	Interface		

- Understand the basic concept of C programming, and its different modules that includes conditional looping expressions, Arrays, Strings, Functions, Pointers, Structures and file programming
- Acquire knowledge about the basic concept of writing a program.
- Role of constants, variables, identifiers, operators, type conversion and other building blocks of language.
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions

## COURSE CONTENT

#### **Computer Programming**

Introduction to C and C++. Pointers, Structure and Files in C. C++ as an Object Oriented Language, Creating Objects, Using member functions, Constructors and Destructors, Classes, and structures and friends, Overloading Operators, File operations in C++, Inheritance, Polymorphism.

#### Interfacing

Microprocessor and Microcontroller Architecture

Digital and Analog converters

Digital I/O

Serial I/O and Data communication

Timers and counters

Data Acquisition systems

Microprocessor based control systems

8. Interface busses ISA, PCI

## **SUGGESTED READINGS:**

1. V. RAJARAMAN, Computer Oriented Numerical Methods, PHI Publication.

2. V. RAJARAMAN, Computer Programming In C, PHI Publication

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED43	<b>Composite Materials</b>	L-T-P:3-0-2	None

- Have knowledge of the types and properties of composites used in engineering.
- Have knowledge in processing and fabrication of structural composites.
- Analyze the effects of various load or displacement boundary conditions by applying laminate analysis to composite structures.
- Understand the differences in matrix materials and the implications for composites as substitute materials in design to meet several competing requirements
- Describe the need, characteristics and applications of composite materials.
- Summarize the importance of surface treatments of fibers and adding fillers and additives to the composite materials.
- Manipulate the interaction between fiber and matrix in a unidirectional lamina under tensile and compressive loading.
- Explain the experimental techniques used for evaluating the fatigue and impact properties.
- Discuss the mechanical behavior of composites due to variation in temperature and moisture.
- Choose the most appropriate manufacturing process for fabricating composite components.

• Identify and design composite materials and structures in various engineering applications

# **COURSE CONTENT**

Introduction: Classification of various composite materials.

Reinforcements: Fibers: fabrication, properties and applications of glass fibers, boron fibers, carbon fibers, organic fibers, Kevelar fibers, ceramic fibers, metallic fibers (metallic glasses). Particulates: Properties and application of SiC, Al2O3, Si3N4 and TiC particulates. Matrix Materials: Properties of common polymer, metallic and ceramic matrix materials.

Metal Matrix Composites: Solid state, liquid state and in-situ fabrication techniques of MMCs, Discontinuous reinforcement of MMCs, Properties and applications of MMCs.

Ceramic Matrix Composites: Fabrication, properties and interfaces in CMCs. Toughness of CMCs, applications of CMCs. Carbon Fiber Composites: Fabrication, properties and interfaces.

Mechanics of Composite Materials: Density, mechanical properties, predication of elastic constants, transverse stresses, and thermal properties. Mechanics of load transfer from matrix to fibers, relationship between engineering constants, analysis of laminated composites.

Strength, Fracture and Design of Composites: Tensile and compressive strength of composites, Fracture modes in composites, Strength of orthotropic lamina, maximum stress theory, maximum strain criterion, maximum work criterion.

## SUGGESTED READINGS:

- 1) S.W. Tsai and H.T. Hahn "Introduction to Composite Materials", Technomic Publishing Co.
- 2) Robert M. Jones, "Mechanics of Composite Materials", McGraw-Hill.
- 3) A.K. Kaw, "Mechanics of composite materials", CRC Press.
- 4) R.J. Crawford "Plastic Engineering, Butterworth-Heinemann publications.
- 5) P.K. Mallick, Marcel Dekker "Fiber-Reinforced Composites- Materials, Manufacturing and Design", Inc. New York

Course No	Title of the Course	Course Structure	Pre-Requisite	
PED44	Micro Electro	L-T-P:3-0-2	None	
	Mechanical Systems			
<b>COURSE OUTCOM</b>	ES (COs)			
• Knowledge of MEN	MS & microsystems.			
• Knowledge of work	king principle of microsy	stems.		
• Knowledge of engin	neering science for micro	osystem design and fabri	cation.	
Knowledge of varie	ous microsystem fabricat	ion processes.		
• Knowledge of micr	osystem design and pack	taging,		
COURSE CONTENT				
Overview of MEMS &	Microsystems; MEMS	and Microsystems, typi	cal products, evolution	
of microsystem, micros	system and microelectror	nics, miniaturization, app	olications.	
Working principles of	Microsystems; Introdu	ction, micro sensors, r	nicro actuation, micro	
accelerometers, microf	luidics.			
Engineering Science for	or Microsystem Design	and Fabrication; Atomi	c structure, ionization,	
molecular theory, dopin	ng of semiconductors, di	ffusion, and plasma phy	sics, electro chemistry,	
quantum physics.				
Engineering Mechanics	s for Microsystems Desig	gn		
Materials for MEMS				
Microsystem Fabrication	on Processes; Photolitho	graphy, ion implantatio	n, diffusion, oxidation,	
chemical vapor deposit	ion, physical vapor depo	sition, deposition by epi	taxy, etching.	
Overview of Micro-ma	nufacturing.			
Microsystem Design.				
wherosystem Packaging	B			
SUCCESTED DEAD	INCS			
JUGGEDIED READINGD: 1 God El Hok "MEMS Handbook" CDC Dross				
2 GTA Kovacs "Mi	icromachined Transduce	rs Sourcebook " McGrav	v Hill	
2. Mara Madau "Eurod	2. O.I.A. Kovaes, Wieronnachnied Hansducers Sourcebook, Wieoraw Hin.			

- 3. Marc Madou, "Fundamental of Microfabrication," CRC Press.
- 4. Richard C. Jaeger,"Introduction to Microelectronic Fabrication," Addison-Wesley.
- 5. M. Elwenspoek and R. Wiegerink, "Mechanical Microsensors," Springer Verlag.
- 6. M. Elwenspoek and H. Jansen, "Silicon Micromachining," Cambridge Press.

Course No	Title of the Course	Course Structure	Pre-Requisite
PED45	CNC Operation and	L-T-P:3-0-2	None
	Programming		

- Understanding of the significance of NC/CNC/DNC and its application in FMS and CIMS.
- Knowledge of basic elements of CNC system.
- Knowledge of NC program generation from CAD models.
- Knowledge of Advance programming.
- Knowledge of recent development in CNC machine tools.

#### COURSE CONTENT

Module-1

Introduction to Computer Numerical Control (CNC) • Numerical control • Functions of a machine tool • Concept of numerical control • Historical Development • Definition • Advantages of CNC machine tools • Evolution of CNC • Advantages of CNC • Limitations of CNC • Features of CNC • The Machine Control Unit (MCU) for CNC • Classification of CNC Machine Tools • CNC MACHINING CENTERS ¬ Classification ¬ Features Of CNC Machining Centers

Module-2

Blue print reading • Reading the machining sketches • Different Geometrical Tolerance symbols. • Reading Dimensional Tolerances. • Understanding the Views. • Concept of First angle & Third angle projection

Module-3

Auto CAD basic (ACAD-01) • Sketching Points line, Circles & Arcs. • Simple exercises based on above. • Isometric Views. • Splines & poly lines • Identifying the points in given drawing

Module-4

Conventional milling Awareness • Introduction to milling machine & its parts. • Different operations of milling. Plain milling Step milling Slot malling Pocket milling Co-ordinate drilling Job setting in vice by dialing Job setting on bed with clamps • Knowledge of different cutting tool materials used • Selecting speed feeds & depth of cut • Indexing(simple & compounding)

Module-4

CNC Milling- Basic • Fundamentals of CNC milling • Familiarization of control panel • Fundamentals of CNC programming • Part programming techniques • Machining practice on CNC Milling • Practice session at Industry

Module-5

Module-6 CNC Turning. • Work piece setting methods • Tool setting methods • Practice on CNC Turning. • Exercises on machine & Practice.

#### **SUGGESTED READINGS:**

Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India.

Course No	Title of the Course	<b>Course Structure</b>	Pre-Requisite
PED46	Advanced Machining	L-T-P:3-0-2	None
	Processes		

- Identify the need and to examine different functional elements of various advanced manufacturing processes and to identify the typical applications theses modern manufacturing processes.
- Examine and evaluate the unconventional manufacturing methods and their classification to use to the right manufacturing method for the right product
- Formulate real production problems creatively, especially in design considerations like material selection and process identification which is very important in the designing of new components.
- Demonstrate the ability to collect data of a given process/system, interpret, analyse data and make some conclusions for the different applications in the industry using variety of modern manufacturing methods such as unconventional machining (EDM, ECM, ECDM, IBM, EBM, PAM etc), micro/nano finishing operations (MRF, AFF, MAF, MRAFF, MFP etc), micro casting, micro forming, additive manufacturing etc.
- Design a process for day to day changing need of market in terms of applications and huge material choices due to advancement in materials technology.

#### COURSE CONTENT

Introduction to advanced machining processes – need for such processes and application areas. Mechanical Energy utilized advanced machining processes like ultrasonic machining, abrasive flow machining, magnetic abrasive finishing, magneto-rheological finishing, abrasive water jet machining – mechanics of cutting, process parametric analysis, process capabilities, applications.

Thermoelectric based advanced machining processes like electro discharge machining, wire EDM, Plasma Arc Machining, Laser Beam Machining, Focussed Ion Beam Machining – working principles, material removal mechanisms, process capabilities and applications.

Electrochemical and Chemical Advanced Machining – ECG, Electrostream Drilling, Chemical Machining – process characteristics, numerical modelling of the processes, applications and limitations.

## **SUGGESTED READINGS:**

- 1. P. C. Pandey and H. S. Shan, "Modern Machining Methods", Tata McGraw Hill Publishing.
- 2. A. Ghosh and A. K. Mallik, "Manufacturing Analysis", East West Press Ltd. New Delhi.
- 3. G. F. Bennedict, "Non-Traditional Manufacturing Processes", Marcell Dekker Inc.
- 4. J. A. McGeugh, "Advanced Methods of Machining", Chapman and Hall Ltd. London.
- 5. P. K. Mishra, "Nonconvetional Machining", Narosa Publishing House, New Delhi.

6. V. K. Jain, "Advanced Machining Processes", Allied Publisher, Mumbai.

# SYLLABUS OF OPEN ELECTIVES

Course No.	Title of the Course	Course Structure	Pre-Requisite	
EO001	Technical	L-T-P: 3-1-0	None	
	Communication			
COURSE OUTCO	MES (COs)			
<ul> <li>The course will improve writing and documentation skills of students with emphasis on the importance of effective communication with focus on choice of words, formation of proper sentence structures and writing styles.</li> <li>This will enhance the students capability to prepare technical documents and correspondence.</li> <li>The course will equip the student with good communications skills for placements, preparing SOPs and CVs.</li> <li>The course will sensitize the students towards research ethics, convright and plagiarism</li> </ul>				
<ul> <li>The course will sensitize the students towards research ethics, copyright and plagtarism.</li> <li>COURSE CONTENT</li> <li>Definition of communication, meaning, importance &amp; process of communication, objectives, types, C's of communication, barriers to communication</li> <li>human &amp; non -human communication, distinctive features of human languages</li> <li>Business correspondence-definition, meaning and importance of business communication, business letters- purchase, enquiry, quotation, order, followup, acceptance-refusal</li> <li>Emphasis on (i) paragraph writing, its kinds, coherence &amp; cohesion         <ul> <li>(ii)writing a paragraph/thesis: selection of topic and its development</li> <li>(iii) writing reports, manuals, notices, memos, agendas, minutes</li> <li>(iv)Interviews, speeches, presentations,</li> </ul> </li> </ul>				
SUGGESTED READINGS:				
<ol> <li>Martin Hewing, "Advanced English Grammar" Cambridge.</li> <li>Meenakshi Raman &amp; Sangeeta Sharma, "Technical Communication" Oxford University Press.</li> </ol>				

Course No.	Title of the Course	Course Structure	Pre-Requisite		
EO002	Disaster Management	L-T-P: 3-1-0	None		
COURSE OUTCOMES (COs)					
<ul> <li>Demonstrate a humanitarian resp</li> <li>Critically evaluat multiple perspect</li> </ul>	critical understanding of hoonse. e disaster risk reduction and ives.	key concepts in disaste	r risk reduction and plicy and practice from		
<ul> <li>Develop an under specific ty Critically unders planning and pro- countries they we</li> </ul>	rstanding of standards of hu pes of disaste tand the strengths and we ogramming in different cou ork in.	amanitarian response and ers and cor aknesses of disaster ma antries, particularly their	f practical relevance in afflict situations. nagement approaches, home country or the		
COURSE CONTEN	T				
Unit -I: Introduction Disaster: Definition, Natural And Manmae Repercussions Of Dia Destruction Of Ecosy Natural Disasters: I Famines, Landslides Accidents, Oil Slicks Unit -II: Disaster Pr Study Of Seismic Ze Areas Prone To Cy Disaster Diseases An Unit -III: Disaster P Preparedness: Monite Application Of Ren Reports: Governmen Unit -IV: Risk Asses Disaster Risk: Conce Risk Situation. Tech Warning, People's Pa Unit -V: Disaster M Meaning, Concept A	n Factors And Significance de Disasters: Difference, Nat sasters And Hazards: Econor ystem. Earthquakes, Volcanisms, And Avalanches, Man-made And Spills, Outbreaks Of D rone Areas In India ones; Areas Prone To Flood clonic And Coastal Hazard d Epidemics Preparedness And Manager oring Of Phenomena Trigger note Sensing, Data From tal And Community Prepared ssment ept And Elements, Disaster niques Of Risk Assessment, articipation In Risk Assessment itigation And Strategies Of Disaster And Non-Structural Mitigat	; Difference Between I nure, Types And Magnituc mic Damage, Loss Of Hu Cyclones, Tsunamis, F e disaster: Nuclear Reacto isease And Epidemics, W ls And Droughts, Landsl s With Special Reference <b>nent</b> ring A Disaster Or Hazar Meteorological And Of dness. Risk Reduction, Global Global Co-Operation In ent. Strategies for Surviva Mitigation, Emerging ion, Programs Of Disaste	Hazard And Disaster; de. man And Animal Life, loods, Droughts And r Meltdown, Industrial Var And Conflicts. ides And Avalanches; ce To Tsunami; Post- d; Evaluation Of Risk: ther Agencies, Media And National Disaster Risk Assessment And al. Trends In Mitigation. r Mitigation In India		

## **SUGGESTED READINGS:**

1. R. Nishith, Singh AK "Disaster Management in India:Perspectives, issues and strategies" New Royal book Company, Lucknow.

2. Sahni, PardeepEt.Al. (Eds.), "Disaster Mitigation Experiences And Reflections". Prentice Hall Of India, New Delhi.

3. Goel S. L. "Disaster AdminastrationAnd Management" Text And Case Studies Deep &Deep Publication Pvt. Ltd., New Delhi

Course No.	Title of the Course	<b>Course Structure</b>	Pre-Requisite
EO003	Basics of Finance	L-T-P: 3-1-0	None
	Management		

- To provide a theoretical framework for considering corporate finance problems and issues and to apply these concepts in practice.
- Enhance knowledge and understanding of financial management.
- How managers should organize their financial transactions effectively and with integrity and how to give everybody the ability and confidence to tackle common financial problems in practice.

• Provide adequate preparation for future finance classes.

## **COURSE CONTENT**

## Unit I

Nature, scope and objectives of financial management, Time value of money, Risk and return (including Capital Asset Pricing Model).

## Unit II

Long term investment decisions: The Capital Budgeting Process, Cash Flow Estimation, Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Net Terminal Value, Internal Rate of Return (IRR), Profitability Index.

## Unit III

Financing Decisions: Sources of long-term financing, Estimation of components of cost of capital, Methods for calculating Cost of Equity, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average Cost of Capital (WACC). Capital Structure-Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach). Operating and Financial leverage. Determinants of capital structure

## Unit IV

Dividend Decisions: Theories for Relevance and irrelevance of dividend decision for corporate valuation-Walter's Model, Gordon's Model, MM Approach, Cash and stock dividends. Dividend policies in practice.

## Unit V

Working Capital Decisions: Concepts of Working Capital, Operating & Cash Cycles, sources of short term finance, working capital estimation, cash management, receivables management, inventory management.

## **SUGGESTED READINGS:**

1. Khan, M.Y. and P.K. Jain, "Financial Management": Text and Problems, Tata McGraw Hill.

2. Srivastava, Rajiv, and Anil Mishra, "Financial Management", Oxford University Press, UK.

3. Chandra, P. "Financial Management-Theory and Practice", Tata McGraw Hill.

4. Horne, Van; James C., John Wachowicz, Fundamentals of Financial Management, Pearson Education.

Course No.	Title of the Course	Course Structure	Pre-Requisite
EO004	Basics of Finance	L-T-P: 3-1-0	None
	Management		

This course is designed to provide students with an understanding of human resource management (HRM) functions within organizations, including an appreciation of the roles of both HRM specialists and line managers in designing and implementing effective HRM policies and practices.

## COURSE CONTENT

#### Unit - I

Evolution and growth of human resource management (with special reference to scientific management and Human relations approaches).Role of HR in strategic management.Nature.objectives, scope, and functions of HR management.

#### Unit - II

Challenges of HR (the changing profile of the workforce - knowledge workers, employment opportunities in BPOs, IT and service industries, Flexi options), Workforce diversity (causes, paradox, resolution of diversity by management).

#### Unit III

HRD; Human resource management as a profession.Concepts of line-staff in the structure of human resource department and the role of human resource manager.

#### Unit - IV

Manpower planning -objectives, elements, advantages, process. Job design - (simplification, rotation, enlargement, enrichment and approaches}.Job analysis.Job evaluation.

#### Unit - V

Recruitment (factors affecting, sources, policy, evaluation). Selection(procedure, tests, interviews). Placement and Induction.

## **SUGGESTED READINGS:**

1. Aswathappa K. "Human Resource and Personnel Management", Tata McGraw-Hill, New Delhi.

2. Chhabra T.N. "Human Resource Management", DhanpatRai and Co. Delhi.

3. Saiyadain S. Mirza "Human Resource Management", Tata Mc-GrawHill, India.

4.Chadha, N.K. Human Resource Management-issues, case studies, experiential exercises, Sri SaiPrintographers, New Delhi.

Course No.	Title of the Course	<b>Course Structure</b>	Pre-Requisite
EO005	Project Management	L-T-P: 3-1-0	None

In this comprehensive course, student will learn the fundamentals of project management: how to initiate, plan, and execute a project that meets objectives and satisfies stakeholders. This course provides a step-by-step guide to planning and executing a project and to develop a manageable project schedule.

## **COURSE CONTENT**

#### Unit-I

Objectives of Project Planning, monitoring and control of investment projects. Relevance of social cost benefit analysis, identification of investment opportunities. Pre-feasibility studies. Unit-II

Project Preparation: Technical feasibility, estimation of costs, demand analysis and commercial viability, risk analysis, collaboration arrangements; financial planning; Estimation of fund requirements, sources of funds.Loan syndication for the projects.Tax considerations in project preparation and the legal aspects.

#### Unit-III

Project appraisal: Business criterion of growth, liquidity and profitability, social cost benefit analysis in public and private sectors, investment criterion and choice of techniques. Estimation of shadow prices and social discount rate.

#### **Unit-IV**

Project review/control-Evaluation of project. PERT/CPM .resource handling/leveling.

#### Unit-V

Cost and Time Management issues in Project planning and management, success criteria and success factors, risk management.

## **SUGGESTED READINGS:**

1. Ravi Ravindran: "Operations Research and Management Science Handbook", CRC Press.

2. Harold Kerzner: "Applied Project Management: Best Practices on Implementation", John Wiley & Sons, Inc.

3. Goodpasture, J. C. "Quantitative Methods in Project Management", J Ross Publishing, Boca Raton, Florida, USA.

4. Meredith, J. R. and Mantel Jr., S. J. "Project Management: A Managerial Approach", John Wiley, New York.

5. Clifford Gray, "Project Management", Richard D. Irwin.

Course No.	Title of the Course	<b>Course Structure</b>	Pre-Requisite
EO006	Basics of Corporate Law	L-T-P: 3-1-0	None

The objective of this Course is to provide in-depth knowledge of the Corporate laws and process related to integrate these aspects of management studies in decision making within an organization; analyze and interpret management information; make decisions based on the information available; communicate information effectively; understand and apply the theoretical aspects of accounting methods used for collecting, recording and reporting financial information; explain and appraise the taxation laws which govern corporations and individuals

#### **COURSE CONTENT**

.Unit I: Introduction : Administration of Company Law, characteristics of a company; common seal; lifting of corporate veil; types of companies including private and public company, government company, foreign company, one person company, small company, associate company, dormant company, producer company; association not for profit; illegal association; formation of company, promoters and their legal position, pre incorporation contract and provisional contracts; on-line registration of a company.

**Unit II: Documents:** Memorandum of association and its alteration, articles of association and its alteration, doctrine of constructive notice and indoor management, prospectus, shelf prospectus and red herring prospectus, misstatement in a prospectus; GDR; book building; issue, allotment and forfeiture of shares, calls on shares; public offer and private placement; issue of sweat capital; employee stock options; issue of bonus shares; transmission of shares, buyback and provisions regarding buyback; share certificate; D-Mat system; membership of a company.

**Unit III: Management and Meetings**: Classification of directors, additional, alternate and adhoc director; women directors, independent director, small shareholders' director; director identity number (DIN); appointment, who can appoint a director, disqualifications, removal of directors; legal position, powers and duties; key managerial personnel, managing director, manager; meetings of shareholders and board; types of meeting, convening and conduct of meetings, requisites of a valid meeting; postal ballot, meeting through video conferencing, e-voting; committees of board of directors – audit committee, nomination and remuneration committee, stakeholders relationship committee, corporate social responsibility committee; prohibition of insider trading.

#### **SUGGESTED READINGS:**

- 1. Franklin Gevurtz, "Global Issues in Corporate Law" Thomson West.
- 2. P. Narayanan, "Law of Copyright and Industrial Designs" Eastern Law House.

Course No.	Title of the Course	Course Structure	Pre-Requisite
EO007	Biological computing	L-T-P: 3-1-0	None
COURSE OUTCOMES (COs)			
• To understand computing in context of biological systems			
• To understand computing languages needed to solve biological problems			
• To acquire computational skills for analysis of biological processes through grid computing			
• To gain knowledge of different biological databases and their usage			
To gain innovative insight into DNA computing			
COURSE CONTENT			
Introduction, Orientation and UNIX,			
Python: Introduction to Variables and Control flow, Python II - Parsing In and Output,			
Python III - Scripting and Functions, Python IV- Number Crunching and Plotting,			
Grid computing, Biogrid, R basics and Visualization, Unix for fast text processing, SQL			
Database			
Biological databases, R for speed, R for fun, Local BLAST, Unit Testing and Code Correctness			
DNA computing,			
SUGGESTED READINGS:			
1. H. Bolouri, R. Paton "Computations in cells & tissues". 1st Edition: Published by Springer			
2 Haubold Bernhard Wiehe Thomas "Introduction to Computational Biology: An			
Evolutionary Approach". Springer			

Course No.	Title of the Course	<b>Course Structure</b>	Pre-Requisite
EO008	Basic of social science	L-T-P: 3-1-0	None

Sociology is a major category of academic disciplines, concerned with society and the relationships among individuals within a society. It in turn has many branches, each of which is considered a "social science".

#### **COURSE CONTENT**

Unit 1.

The Development of Sociology in the 19th Century

## Unit 2. Sociology as Science:

- a. Science, scientific method and critique.
- b. Major theoretical strands of research methodology.
- c. Positivism and its critique.
- d. Fact value and objectivity.
- e. Non- positivist methodologies.

## Unit 3. Religion and Society:

- a. Sociological theories of religion.
- b. Types of religious practices: animism, monism, pluralism, sects, cults.
- c. Religion in modern society: religion and science, secularization, religious revivalism, fundamentalism.

## Unit 4. Politics and Society:

- a. Sociological theories of power.
- b. Power elite, bureaucracy, pressure groups, and political parties.
- c. Nation, state, citizenship, democracy, civil society, ideology.
- d. Protest, agitation, social movements, collective action, revolution.

## Unit 5. Sociological Thinkers:

- a. Kar l Marx- Historical materialism, mode of production, alienation, class struggle.
- b. Emile Durkheim- Division of labour, social fact, suicide, religion and society.
- c. Max Weber- Social action, ideal types, authority, bureaucracy, protestant ethic and the spirit of capitalism.
- d. Talcolt Parsons- Social system, pattern variables.

- e. Robert K. Merton- Latent and manifest functions, conformity and deviance, reference groups.
  - f. Mead Self and identity.

## **SUGGESTED READINGS:**

- 1. Beteille, Andre, "Sociology: Essays in Approach and Method", Oxford University Press.
- 2. Giddens, Anthony, "Sociology", Polity Press.
- 3. Weber, M. "The Methodology of the Social Sciences". New York: Free Press.
- 4. Durkheim, E. "The Rules of Sociological Method". London: Macmillan.
| Course No. | Title of the Course | <b>Course Structure</b> | Pre-Requisite |
|------------|---------------------|-------------------------|---------------|
| EO009      | Entrepreneurship    | L-T-P: 3-1-0            | None          |

This Course Aims at Instituting Entrepreneurial skills in the students by giving an overview of who the entrepreneurs are and what competences are needed to become an entrepreneur. contents:

#### **COURSE CONTENT**

#### **Unit I-Introduction:**

Concept and Definitions, Entrepreneur v/s Intrapreneur; Role of entrepreneurship in economic development; Entrepreneurship process; Factors impacting emergence of entrepreneurship; Managerial versus entrepreneurial Decision Making; Entrepreneur v/s Investors; Entrepreneurial attributes and characteristics; Entrepreneurs versus inventors; Entrepreneurial Culture; Women Entrepreneurs; Social Entrepreneurship; Classification and Types of Entrepreneurs; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs.

#### **Unit II- Creating Entrepreneurial Venture**:

Generating Business idea- Sources of Innovation, methods of generating ideas, Creativity and Entrepreneurship; Challenges in managing innovation; Business planning process; Drawing business plan; Business plan failures; Entrepreneurial leadership- components of entrepreneurial leadership; Entrepreneurial Challenges; Legal issues – forming business entity, considerations and Criteria, requirements for formation of a Private/Public Limited Company, Intellectual Property Protection- Patents Trademarks and Copyrights – importance for startups, Legal Acts Governing Business in India.

#### **Unit III-Functional plans:**

Marketing plan– for the new venture, environmental analysis, steps in preparing marketing plan, marketing mix, contingency planning; Organizational plan – designing organization structure and Systems; Financial plan – pro forma income statements, pro forma cash budget, funds Flow and Cash flow statements; Pro forma balance sheet; Break Even Analysis; Ratio Analysis.

#### **Unit IV- Entrepreneurial Finance:**

Debt or equity financing, Sources of Finance- Commercial banks, private placements, venture capital, financial institutions supporting entrepreneurs; Lease Financing; Funding opportunities for Startups in India.

## **Unit V- Enterprise Management:**

Managing growth and sustenance- growth norms; Factors for growth; Time management, Negotiations, Joint ventures, Mergers & acquisitions.

## **SUGGESTED READINGS:**

Kumar, Arya, "Entrepreneurship: Creating and Leading an Entrepreneurial Organization" Pearson, India.

Course No.	Title of the Course	<b>Course Structure</b>	Pre-Requisite
EO0010	Social work	L-T-P: 3-1-0	None

In this course students will learn about various methods of social work, about community organization, social welfare administration, Problems pertaining to Marriage, Family and caste **COURSE CONTENT** 

#### Unit 1.Social work

Philosophy and Methods. Social work: Meaning, Objectives, Scope, Assumptions & Values; History of Social work in U.K. U.S.A.and India, philosophy of Social Work. Democratic (Equality, Justice Liberty & Fraternity) and Humanitarian (Human Rights) Matrix.Social works as a profession.

#### Unit 2. Methods of Social work

Meaning, Scope Principles, Processes (Psychosocial study, Assessments, treatment-goal formulation and techniques), Evaluation, Follow-up and Rehabilitation. Social Groups work: Meaning,Objective, Principles, Skills, Processes (Study, Diagnosis, treatment and evaluation), Programme, Planningand Development, Role of Social group worker, Leadership Development.

Unit 3 Community organizationMeaning, Objective, Principles, Approaches, Roles of<br/>OrganizationCommunityOrganizationWorker.

#### **Unit 4 Social Welfare Administration**

Meaning Scope, Auspices-Private and Public, Principles, Basic Administrative Processes and Practice decision making communication, planning.organisation, budgeting and finacial control, reporting. Social work Research: Meaning objectives, types, scope, scientific method, Selection and formulation of the problem Research Design Sampling, Sources and Methods of Data Collection, Processing of Data, analysing and interpretation, Report writing. Social Action: Meaning,Scope, approaches (Sarvodays, Antyodaya etc.) and Strategies.

#### Unit 5 Work in India Problem pertaining to Marriage, Family and caste

Dowry- child Marriage, Divorce, Families with working couples, Disorganised Families, Families with Emigrant Heads of the Households, Gender Inequality, Authoritarian Family structure, Major Changes in Caste systems and problem of casteism. Problems Pertaining of Weaker Sections. Problems of Children, Women Aged. Handicapped and Backward Classes

## 1949/Appendices/AC-Minutes/2016-17

(SCs, STs, and other Backward Classes). **Problems of Deviance:** Truancy Vagrancy and Juvenile Delinquency, Crime, White Colla Crime, Organized Crime, Collective Violence, Terrorism, Prostitution and Sex Related Crimes. Social Vices: Alcohilism. Drug Addiction, Beggary, Corruption and communalism. **Problems of Social Structure :** Poverty, Unemployment, Bonded Labour, Child Labour. **Fields of Social work India :** Child Development, Development of Youth, Women's Empowerment, Welfare of aged, Welfare of Physically. Mentally and Social Handicapped, Welfare of backward Classes (Scs, STs and Other Backward Classes) Rural Development Urban Community Development, Medical And Psychiatric Social work, Industrial Social work, Social Security offender Reforms.

#### **SUGGESTED READINGS:**

- 1. Malcolm Payne Modern, "Social Work Theory" Palgrave MacMillan.
- 2. Sanjay Bhattacharya, "Social Work: An Integrated Approach" Deep & Deep Publications.

Course No.	Title of the Course	<b>Course Structure</b>	Pre-Requisite
EO011	IP and Patenting	L-T-P: 3-1-0	None

The objective of this Course is to provide in-depth knowledge of the laws and process related to Trademarks, Copyrights and other forms of IPs with focus on Patents, the Indian and International Patent filing procedure, drafting patent application and conducting prior art searches. Students will be exposed to the technical, management and legal aspects of IP and Patents.

#### COURSE CONTENT

**UNIT I: Introduction:** Historical and philosophical background of patents and other intellectual property, Patent System: the Constitution, Congress, Patent Office (PTO), and courts; Analyzing and understanding judicial opinions

**UNITII:** Comparative overview of patents, copyrights, trade secrets, and trademarks: Legal fundamentals of patent protection for useful inventions, Design and plant patents, Legal fundamentals of copyright protection, Similarity and access, Expression vs. ideas and information, merger, Fair use of copyrighted works (e.g., for classroom use), Contributory copyright infringement, Critical differences between patent and copyright protection, Copyright infringement distinguished from plagiarism, Legal fundamentals of trade-secret protection, Legal fundamentals of trademark protection

**UNIT III: Requirements and limitations of patentability:** New and useful: (A) The legal requirement of novelty (B) First to invent vs. first inventor to file, The legal requirement of non-obviousness.

**UNIT IV: The process of applying for a patent ("patent prosecution"):** Anatomy of a patent application, Adequate disclosure, The art of drafting patent claims, Patent searching: (A) Purposes and techniques, Actions for patent infringement, Interpretation of claims, Doctrine of equivalents, Product testing as a possibly infringing use, Doctrine of exhaustion

#### **SUGGESTED READINGS:**

Rines, Robert H. "Create or Perish: The Case for Inventions and Patents", Acropolis

.Course No.	Title of the Course	Course Structure	Pre-Requisite
EO012	Supply Chain Management and Logistics	L-T-P: 3-1-0	None

Supply chain management consist of all parties (including manufacturer, marketer, suppliers, transporters, warehouses, retailers and even customers) directly or indirectly involved in fulfillment of a customer. The main objective is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for a business firm.

#### **COURSE CONTENT**

## Unit I

**Introduction:** Concept of supply chain management (SCM) and trade logistics; Scope of logistics; Logistic activities – an Overview; Contribution of logistics at macro and micro levels; SCM and trade logistics; Business view of SCM; Concept, span and process of integrated SCM; Demand management – methods of forecasting; Supply chain metrics (KPIs), performance measurement and continuous improvement; Product development Process and SCM; Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle.

#### Unit II

**Managing Relationship:** Role of Relationship marketing in SCM; Managing relationships with suppliers and customers; Captive buyers and suppliers; Strategic partnerships; Supplier-retailer collaboration and alliances.

#### Unit III

**Focus Areas of Logistics and Supply Chain management:** Transportation-Importance of effective transportation system; Service choices and their characteristics; inter-modal services; Transport cost characteristics and rate fixation; In-company management vs. out-sourcing; World sea borne trade; International shipping- characteristics and structure; Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Development in sea transportation-Unitization, containerisation, inter and multimodal transport; CFC and ICD. Air transport: Set up for air transport and freight rates; Carriage of Goods by sea -Role and types of cargo intermediaries. Warehousing and inventory management: Reasons for warehousing; Warehousing evaluation and requirements; Warehousing location strategies; Inventory management principles and approaches; Inventory categories -EOQ, LT, ICC **Unit IV** 

**IT Enabling Logistics and Supply Chain:** Technology in logistics – EDI, bar Coding, RFID etc., data warehousing, electronic payment transfers; Business management systems; TRADITIONAL ERP, SPECIAL ERP, MR, DRP, PDM, EIP, CPFR, WMS, TMS; Re-

engineering the supply chain- Future directions. **Unit V** 

**Trends and Challenges in logistics and supply chain management:** Third party logistic outsourcing –challenges and future directions.

## **SUGGESTED READINGS:**

1. Christopher, M., "Logistics and Supply Chain Management", Prentice Hall.

2. Handfield and Nicholas, Jr., "Introduction to Supply Chain Management", Prentice Hall.

3. Jhon J Coyle, C. JhonandLangley,Brian J Gibs, "Logistics approach to Supply Chain Management", Cengage Learning.

Course No	Title of the Course	Course Structure	Pre-Requisite
EO013	ORGANISATION	L-T-P: 3-1-0	None
	DEVELOPMENT		

Organisation Development is a growing field of Human Resource Management. It has its foundations in a number of behavioural and social sciences.

#### **COURSE CONTENT**

Topics included are

Organtzattonal Systems and Human Behaviour - Developing a basic knowledge of how organizattons and groups function as systems; introducing and discussing various theoretical approaches and issues.

Interpersonal and Consulting Skills - Increasing effectiveness as a change agent by providing a variety of opportunities in order to increase self-awareness, practice alternative ways of approaching personal and interpersonal problem-solving and develop basic consulting and interviewing skills.

Introduction to organization development - introducing some basic theories, models and methods in the field of organization development, especially those relating to the role of consultant and strategies for change.

Intervention and Change in Organizations - Consolidating and further developing consulting skills and strategies

Action Research Project - Carrying out a change activity in an organization, while also researching the effects and or the process. This provides participants with an opportunity to consolidate and demonstrate skills and knowledge gained in other units of the course.

#### **SUGGESTED READINGS:**

- 1. W. Burke and Debra Noumair, "Organization Development" Pearson.
- **2.** Chris Argyris and David Schon, "Organizational Learning II Theory, Method, and Practice" Pearson.

Course No	Title of the Course	Course	Pre-Requisite
		Structure	
EO014	Industrial organization and	L-T-P: 3-1-0	None
	managerial economics		

This course help students in understanding the basics of management and Industrial organization.

#### **COURSE CONTENT**

**Unit I:** Principles of management, General idea, various functions, scope of engineering. Organisation structure, Types, merits and demerits.

**Unit II:** Plant location and layout, Factors effecting location, types of layout. Production planning and control, Sequence of planning and control of production. Scheduling , routing, despatching., Methods Study, Methods analysis, time study methods of rating.

**Unit III:** General idea of personnel management, Industrial psychology, job evaluation and monitoring. Business decision making and forward planning. Demand and demand forcasting of production analysis- prices and pricing decision-profit and capital, management. Analysis of inter-industry relation, macro-economics and business.

### **SUGGESTED READINGS:**

- 1. Koutsoyiannis, "Modern Microeconomics" International Edition.
- 2. Pearson and Lewis, "Managerial Economics" Prentice Hall.
- 3. G.S. Gupta, "Managerial Economics" T M H, New Delhi.

Course No	Title of the Course	Course Structure	Pre-Requisite
EO015	Global Strategies and	L-T-P: 3-1-0	None
	Technology		

This subject focuses on the specifics of strategy and organization of the multinational company, and provides a framework for formulating successful and adaptive strategies in an increasingly complex world economy.

## **COURSE CONTENT**

Globalization of industries, the continuing role of country factors in competition, organization of multinational enterprises, and building global networks, Analysis of competitive situations from the general management point of view, including fit between key environmental forces and the firm's resources, and changes in these over time. Formulating and implementing strategy based on that analysis. Developing and leveraging a firm's core competencies to gain long-term sustainable advantage.

## **SUGGESTED READINGS:**

1. Mike W. Peng, "Global strategy" Cengage Learning.

2. Pankaj Ghemawat, "Redefining Global Strategy" Harvard Business Press.

Course No	Title of the Course	Course Structure	Pre-Requisite
EO016	Engineering System	L-T-P: 3-1-0	None
	analysis and Design		

The students will learn about system definitions and role of system analyst. They will learn about system modeling and design. They will be exposed to System Implementation and Maintenance issues.

## COURSE CONTENT

## Unit 1

System definition and concepts: Characteristics and types of system, Manual and automated systems

Real-life Business sub-systems: Production, Marketing, Personal, Material, finance Systems models types of models: Systems environment and boundaries, Real time and distributed systems, Basic principles of successful systems

## Unit 2

Systems analyst: Role and need of systems analyst, Qualifications and responsibilities, Systems Analyst, agent of change.

Various phases of systems development life cycle: Analysis, Design, Development, Implementation, Maintenance

#### Unit3

Systems Design and modeling: Process modeling, Logical and physical design, Design representation, Systems flowcharts and structured charts, Data flow diagrams, Common diagramming conventions and guidelines using DFD and ERD diagrams. Data Modeling and systems analysis, designing the internals: Program and Process design, Designing Distributed Systems

## Unit 4

User Interfaces – Relational Analysis – Database design – program design – structure chart – HIPO – SSADM – Alternate Life cycles – Prototypes.

## Unit 5

System Implementation and Maintenance: Planning considerations, Conversion methods, producers and controls, System acceptance Criteria, System evaluation and performance, Testing and validation, Systems qualify Control and assurance, Maintenance activities and issues.

## SUGGESTED READINGS:

1) Haryszkiewycz, "Introduction to Systems Analysis and Design", II Ed. PHI.

2) James A Senn : "Analysis and Design of Information Systems", McGraw Hill.

# 1957/Appendices/AC-Minutes/2016-17

Course No	Title of the Course	Course Structure	Pre-Requisite	
EO017	BIOLOGY FOR	L-T-P: 3-1-0	None	
	ENGINEERS			
COURSE OUTCOM	ES (COs)			
General understand	ing of organization in bi	ological systems		
Conceptual knowle	dge of functioning in bio	ological systems		
Clarity about releva	ance of Biology to engine	eering graduates		
• Understanding hum	an body or any other sui	table organism as a stud	y-model for	
engineering student	s.	C		
Understanding elec	trical, chemical and mag	netic forces, and commu	inication networks in	
bio system.				
COURSE CONTENT				
The Biological system	<ul> <li>An Introduction; Biom</li> </ul>	olecules & self-assembl	ies; Molecular	
recognition; Bioenerge	tics; Communication net	work in biosystem; Mec	hanics in biology;	
Storage, preservation a	nd propagation of biolog	ical information; Bioma	terials in engineering	
applications; Organism	s as factories for biomate	erials; Engineering organ	nisms for novel	
applications				
SUGGESTED READINGS:				
1. T. Johnson "Biology for Engineers", CRC Press.				
2. Michael Small, "Dynamics of Biological system", CRC Press.				
3. Johnny T. Ottesen, MS Olufsen, JK Larsen "Applied Mathematical Models and Human				
Physiology", Published by Society for Industrial and Applied Mathematics,				
4. Michael Roberts, Michael Jonathan Reiss, "Advanced Biology", Grace Monger				
6. Colin Ratledge, "Basic Biotechnology", Bjorn Kristiansen (Ed.).				

EO018       Energy, Environment and Society       L-T-P: 3-1-0       None         COURSE OUTCOMES (COs)       To be able to assess the energy resources available worldwide         To understand the negative impact of conventional energy resource utilization on			
and Society         COURSE OUTCOMES (COs)         • To be able to assess the energy resources available worldwide         • To understand the negative impact of conventional energy resource utilization on			
<ul> <li>COURSE OUTCOMES (COs)</li> <li>To be able to assess the energy resources available worldwide</li> <li>To understand the negative impact of conventional energy resource utilization on</li> </ul>			
<ul> <li>To be able to assess the energy resources available worldwide</li> <li>To understand the negative impact of conventional energy resource utilization on</li> </ul>			
• To understand the negative impact of conventional energy resource utilization on			
ecosystem			
• To learn about various types of pollutions and their control strategies			
• To understand renewable energy resources and their socio-economic impact.			
COURSE CONTENT			
Introduction to Environment, Energy and its impact on society			
Universe, Environment and Ecosystem: Origin of earth, atmosphere, Origin of Life,			
Ecosystem, Biotic and abiotic components, Ecological pyramids, Food chain, Food web,			
Habitat and Niche, Major ecosystems, Atmosphere, Biodiversity			
Pollution: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution			
Energy: Different sources of Energy, Renewable sources of energy, Nonrenewable energy,			
Bioenergy, Bioethanol and Biodiesel			
Biofertilizers, Biopesticides and Biopolymers			
Environmental Ethics and Morals			
SUGGESTED READINGS:			
1. Kishore V V N, Editor, "Renewable Energy Engineering and Technology, Principles			
and Practice", The Energy and Resources Institute (TERI).			
2. G. N. Tiwari and M. K. Ghosal, "Fundamentals of Renewable Energy Sources",			
Narosa Publishing House.			
3. Mital K. M, "Biogas Systems: Principles and Applications", New Age International			
publishers (P) Ltd.			
<ul> <li>4. INIJaguna, B.I., Biogas Technology, New Age International publishers (P) Ltd.</li> <li>5. D. Vagi Conversion Fronk Knoith, Jon F. Knoiden "Dringingles of Solar Frankswine".</li> </ul>			
2nd Edition Taylor & Francis			
2 A Development of Marchanician Charamisinoff Casification Tachnologies A Driver for			
Figure and Scientists Taylor and Francis			

Course No	Title of the Course	Course Structure	Pre-Requisite
EO019	Public Policy and	L-T-P: 3-1-0	None
	Governance		

Students will be introduced to Public Policy and Administrative governance. They will also learn about Administrative Governance.

#### **COURSE CONTENT**

**Unit 1** Introduction to Public Policy and Administrative Governance: Introduction to public policy, econometrics for policy research, policy analysis, economics for public decision making.

**Unit 2** Public Bureaucracy in Theory and Practice: Benefit cost analysis, public budgeting, revenue and expenditures, managing and leading public service organisations.

**Unit 3** Administrative Governance: The Challenge of Policy Implementation, public and non-profit programme evaluation.

**Unit 4** Non-state Actors in Policy-making and Administrative Governance: governance in twenty-first century, Social Diversity and the Question of "Difference" in Policy-making and administrative Governance

#### **SUGGESTED READINGS:**

- 1. John Shields and B. Mitchell Evans. *Shrinkingthe State: Globalization and Public administration "Reform."* Halifax: Fernwood.
- 2. Beryl Radin, Beyond Machiavelli: Policy Analysis Reaches Midlife, 2nd edition. Washington, DC: Georgetown University Press.
- 3. Frank R. Baumgartner, Jeffrey M. Berry, Marie Hojnacki, and David C. Kimball, Lobbying and Policy Change: Who Wins, Who Loses, and Why. Chicago, IL: University of Chicago Press.
- 4. Timothy Conlan, Paul Posner, and David Beam, Pathways of Power: The dynamics of National Policymaking. Washington, DC: Georgetown University press.

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