# PREFACE

Indian Institute of Technology, Gandhinagar (IITGN) is one of the Institutes of Technology in the country, set up with the objective of making available facilities for higher education, research and training in various fields of Science and Technology. The institute has recently been established and the first batch of the B.Tech. programme has been inducted through JEE-2008. IIT Bombay has been identified as the mentoring institute for IIT Gandhinagar. IIT Bombay's vision to be the fountainhead of new ideas and innovators in technology and science is inherently available to IITGN also. IITGandhinagar look forward to create an ambiance in which new ideas, research and scholarship flourish and from which the leaders and innovators of tomorrow emerge.

To begin with three disciplines viz. Chemical Engineering, Electrical Engineering and Mechanical Engineering has been started w.e.f. academic year 2008-09. IIT GN also follows the specialized semester based academic system for imparting education as is prevalent in other IITs. There are two Semesters in an academic year (*Autumn* – July-Nov; and *Spring* – January-April). The students are required to follow the laid down procedures and meet the academic requirements of each semester to progress in their respective study programme. The courses of study bulletin contain the curricula and syllabi for the 4year B.Tech. degree of IIT Gandhinagar. The curricula for the firs two semesters are common to all disciplines. However, the remaining curricula are discipline / department oriented.

The academic programmes of the institute is governed by Rules and Regulations approved by the Academic Council from time to time. The Academic Council is a statutory and supreme body that governs all academic matter and rulings of Chairman, Academic Council are final in regard to all academic matters. The Academic Council continuously monitors the academic programmes and makes appropriate modifications / improvements as and when required in the courses of study.

We are looking forward to make IIT Gandhinagar, a student-oriented place and our endeavor is to ensure that the students get the best of every thing that is needed to create outstanding scientists and engineers.

We wish our students a very bright and successful career.

July, 2009

Dean (AP/SA)

# INTRODUCTION

Bachelor of Technology (B.Tech.) programmes consists of courses in basic sciences, humanities and social sciences, engineering and technology and other related topics. The sequence of studies broadly consists of three phases.

The first phase is an intense study of sciences, mathematics and humanities for deeper understanding of concepts than what was done in school. This is common for all UG Programmes.

The second phase is the study of engineering sciences and technical arts (*such as workshop, engineering graphics, etc.*). This emphasizes a broad based knowledge in general engineering, and engineering methodologies, and enables the students to appreciate the links between science and engineering. This phase is also, by and large, common for all UG programmes, and overlaps with the first phase.

In the third phase, the students are exposed to subjects in their chosen areas of study, designed to train them in the methodologies of analysis of problems and synthesis of solutions. The courses dwell on the principles governing systems and processes, and develop in them the ability for physical and analytical modeling, design and development. They are also introduced to engineering practice through laboratory courses, works visits, practical training, projects etc., and these may vary from discipline to discipline.

In parallel with the third phase, students can strive to broaden their perspectives through two open electives where s/he can take courses drawn from across the Institute.

At various stages of the programme, students are initiated into research methodologies, library reference work, use of engineering and scientific equipments / instruments, learning of modern computational techniques, writing of technical and scientific reports and effective communication.

Apart from the minimum credit requirements for the award of the degree, opportunities exists for supplementing the learning experience by crediting additional courses, in diverse areas. These additional credits when they are in focused areas can earn the students credentials like Minor / Honors.

At present creation of the infrastructural facilities and processes for recruitment of various faculty positions are under progress, hence, it may not be possible to offer Minor courses immediately w.e.f. 2<sup>nd</sup> year. However, Minor / Honors courses will be offered to the students at the earliest possible opportunity.

The requirements for degree programmes run by the Institute are broadly classified as:

- Institute Requirements (further divided into Compulsory courses, Elective courses and other requirements.)
- **Departmental Requirements (***further divided into Compulsory courses, Elective courses and other requirements***).**

Syllabuses of various programmes are given in the this courses of study Bulletin.

# Organizational Structure for Academic Administration

The academic programmes of the Institute are governed by Rules and Regulations approved by the Academic Council from time to time. The Academic Council is the supreme body that governs all academic matters of the Institute, and the rulings of Chairman, Academic Council (i.e. the

Director of the Institute) are final in regard to all academic issues. A definite time schedule is set by the Council for various academic activities, through an Academic Calendar issued in the beginning of each academic year. The Council continuously assesses the academic programmes and makes appropriate revisions / modifications / improvements as and when required through the Institute level committee known as the Under-Graduate Programmes Committee (UGPC). Dean of Academic Programmes (Dean, AP) is the Convener of the UGPC. Similarly, performance of each student is monitored by another committee known as Under-Graduate Performance Evaluation Committee (UGAPEC). These two committees make recommendations to the Academic Council, and, in turn seek / receive opinions / recommendations, as and when required, from the Department level committees known as Department Under-Graduate Committee (DUGC) in each department. The DUGCs handle all academic matters, related to both academic programmes as well as performance of individual students. The Head of the Department is the Convener for DUGC. Administrative back-up for all academic matters is provided by the Academic Office, with a Deputy / Asstt. Registrar (Academic) as in-charge.

On joining the Institute, a student or a group of students is/are assigned to a Faculty Advisor from his/her Department. Students are expected to consult the Faculty Advisor on any matter relating to their academic performance and the courses they may take in various semesters / summer terms. The idea of a Faculty Advisor has been evolved to extend guidance to the students enabling them to complete their courses of study for the required degree in a smooth and satisfactory manner. If on any academic matter a student would like to approach this administrative structure, it is always through the DUGC with advice and recommendations from her /his Faculty Advisor.



Organizational structure for academic matters

# CURRICULUM / PROGRAMME OF STUDY

# Curriculum

Every Department has a prescribed course structure which in general terms is known as the Curriculum or the Courses of Study (CoS). It prescribes all the courses / labs. / other requirements for the degree and sets out the nominal sequence semester-wise. It also gives the syllabus and a list of text / reference books for each course. This booklet contains the courses of study approved recently by the Academic Council of IIT Gandhinagar.

# Semester - autumn, spring, summer

As mentioned earlier, IIT Gandhinagar follows a specialized credit-based semester system. There are two regular semesters in a year. The semester that begins in July (*July to Nov.*) is known as the *Autumn Semester* or *Semester 1* and the semester that begins in January (*Jan. to April*) is known as the *Spring Semester* or *Semester 2*. During the summer vacation, i.e., (May-June), there is one additional semester for summer courses known as the *summer term. A* few numbers of courses may be offered during the summer terr, allowing students to clear failed/dropped courses, or courses towards the requirement of Minor/Honors etc.

# **Course Credit Structure**

In general a certain quantum of academic work measured in terms of credits is laid down as the requirements for a particular degree. A student earns credits by satisfactorily clearing courses/other academic activities every semester. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly the credits associated with any of the other activities are dependent upon the quantum of work expected to be put in for each of the other activity per week.

# Theory and Laboratory Courses

Courses are broadly classified as *Theory courses* and *Laboratory Courses*. Theory courses consist of lecture (L) and tutorial (T) hours, but may have attached practical (P) hours in special cases. Laboratory courses consist of practical hours, but may have attached tutorial hours in special cases. Credit (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of two (2) for lecture and tutorial hours, and a multiplier of one (1) for laboratory hours. Thus, for example, a theory course having two lectures and one tutorial per week throughout the semester carries a credit of 6. Similarly, a laboratory course having one tutorial and three laboratory hours per week throughout semester carries a credit of 5. For example -

Theory course			Laboratory course				
L	Т	Р	С	L	Т	Ρ	С
2	1	0	6	0	1	3	5

In the Courses of Study bulletin, if a course is shown as, say, *CE304 Soil Mechanics II: 2 1 0 6*, it indicates the following:

Theory	course
Course detail	Indicates the following
CE	Alphabetic code for Civil Engineering Department course.
3	Year / Level code (This indicates that the course is offered in the Third year)
04	Serial Number and the Semester indicator ( <i>last digit indicates even or odd semester. Even = Spring Semester; Odd = Autumn Semester</i> )
Soil Mechanics II	Title of the course
2106	LTPC (credit structure)

# Laboratory Course - (CE218: Hydraulic Design Lab.: 0 1 3 5)

Course detail	maicales the following
CE	Alphabetic code for Civil Engineering Department course.
2	Year / Level code (This indicates that the course is offered in the Second year)
18	Serial Number and the Semester indicator ( <i>last digit indicates even or odd</i> semester. Even = Spring Semester; Odd = Autumn Semester)
Hydraulic Design Lab	Title of the course
0135	LTPC (credit structure)

Lab courses usually have either a 1 or a 6 as the middle digit in the course number.

Other academic activities consist of Seminar and Projects, Practical Training, Works Visit and

NSO/NSS/NCC. These are credit as well as non-credit requirements. Seminars, Projects are credit requirements, whereas NSO / NSS / NCC, Practical Training (PT), Works Visit etc. are non-credit requirements.

### Minimum credit requirements and planning of individual academic programme

Depending on the discipline, the minimum credit required for award of a B.Tech. degree is between **252** and **264**. This is nominally divided into 108 credits as Institute requirements and 144 -156 credits as Departmental requirements. The credits are distributed semester-wise as shown in the Courses of Study bulletin for each department. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the students. Some courses do, in addition, specify passing in courses offered earlier in the programmes as pre-requisites. Students are expected to follow the semester-wise schedule of courses given in the Courses of Study bulletin; they do, however, have a freedom to follow alternative schedules to optimize their academic profile with additional learning, keeping the requirements for each course in mind. For students with backlog courses, such rescheduling may even become necessary. Such departures from suggested schedules need to be done very carefully, and always with advice from the Faculty Advisor.

### **Opportunities for Additional Learning: Minor and Honors etc.**

(will be offered as soon as the infrastructural facilities and faculty requirement is met.)

The B.Tech. Programme recognizes the fact that students' aspirations, on one hand, and the demands of the work place, on the other, have become highly diverse. Every student has specific abilities, interests and career goals. Employers too look for people with different combinations of competencies and flavors.

Each department prescribes a minimum of credits, and courses that would qualify a candidate for the award of the B.Tech. degree. As mentioned earlier, the total credits for the B.Tech. programme for example varies between **252-264** depending on the discipline. This approximately converts itself into about four theory courses and one or two laboratory courses or other activities like seminar, project, etc., every semester. All the students in that discipline require undergoing this programme. This minimum content may not have much flexibility.

It is expected that all students with reasonably good academic standing, utilize this surplus time for enhancing their academic learning experience, though the initiative is left entirely to them. They can use it to credit an assortment of courses / projects anywhere in the Institute, (subject to requirements of each of these courses being met), to gain a wide exposure. These additional academic accomplishments will find a separate mention in the transcript. They can also credit focused activities which can qualify as a Minor / Honors (details below). They may alternatively devote part or all of the additional time for extra-curricular activities (including social work) if they so desire, and gain hands-on administrative / managerial / aesthetic skills or sensitivity towards social issues.

Since seats available in such courses will always be limited and competition severe, students aspiring to do these additional courses have to maintain high academic standing to register in these courses. Sustained hard work and diligence throughout the duration of the programme is necessary to maintain the academic standing and gain entry to courses of one's choice.

This additional time will be used by students with backlogs (failed or dropped courses) to clear them with proper classroom learning. They may not be able to take the courses towards additional accomplishments mentioned above, if any of her/his backlog courses is running in a particular semester, or s/he does not have adequate academic standing.

### MINOR

Minor is an additional credential a student will earn if s/he does 30 credits worth of additional learning in a discipline other than her/his major discipline of B.Tech. degree. All academic units in the Institute will offer minors in their disciplines, and will prescribe what set of courses and/or other activities like projects is necessary for earning a minor in that discipline.

A student **does not pre-register** for a Minor. S/he accumulates credits by registering for the required courses, and if the requirement for a particular Minor is met within the prescribed minimum time limit for the course, the Minor will be awarded. This will be mentioned in the Degree Certificate as "*Bachelor of Technology in xxx with Minor in yyy.*" The fact will also be reflected in the transcript, along with the list of courses taken.

Since the number of seats available for each of the courses will always be limited, one has to compete for a place in every course. Maintaining a high academic standing therefore is essential for completing all the requirements for a Minor as mentioned earlier. Even if one specified course cannot be earned during the course of the programme, that Minor will not be awarded. The individual course credits earned however will be reflected in the respective grade card / transcript.

For the award of the Minor, all requirements towards the basic degree and the Minor have to be completed within the stipulated period of the programme one is registered for.

### HONORS

Honors is an additional credential a student will earn if s/he opts for and earns the extra 30 credits in her/his **own discipline**. The concerned department specifies the credit requirements for earning the Honors. Honors are not indicative of class.

As in the case of Minors, a student **does not register for Honors**. S/he accumulates credits by registering for the required courses. On successful accumulation of credits at the end of the programme, honors will be awarded and mentioned in the Degree Certificate as "Bachelor of **Technology in xxx, with Honors.**" The fact will also be reflected in the transcript, along with the list of courses etc. taken.

For the award of the honors, all requirements towards the basic degree and the honors have to be completed within the stipulated period of the programme one is registered for.

### Two Minors etc. for Students with Excellent Academic Standing

Students with excellent standing (Category I,  $CPI \ge 8.0$ , no backlogs) can opt for earning two Minors and / or an Honors and a Minor, if time table permits, by overloading courses as per rule. Students should however, take due care to see that they are not over stretching themselves by opting for such overloads over extended periods.

### Semester-wise registration

IIT Gandhinagar follows a specialized credit based semester system, therefore registration at the beginning of each semester on the prescribed dates announced in the Academic Calendar, is mandatory for every student till s/he completes her/his programme. If a student do not register in a particular semester without prior permission of the UGAPEC, her/his studentship is liable to be canceled. Students are not permitted to re-register for course/(s), which they have already passed. Any academic activity (course / seminar / project etc) undergone by a student without registration will not be counted towards the requirements of her/his degree.

A separate booklet containing the rules and regulations for governing B.Tech. programme as approved by the Academic Council is also available. It would be desirable for all the students to through the rules and regulations booklet and get fully acquainted with the academic system of the Institute.

Semester	1				
Course code	Course Name	Credit structure			
		L	Т	Р	С
CH 101	Chemistry	2	1	0	6
CS 101	Computer Programming & Utilization	2	0	2	6
HS 101 HS 103	English Language Course * Introduction to Philosophy	3	0	0	6
MA 101	Calculus	3	1	0	8
PH 101	Electricity and Magnetism	2	1	0	6
PH 111	Physics Lab.	0	0	3	3
ME 101	Engineering Graphics & Drawing	0	1	3	5
NC 101#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 101#	National Sports Organization (NSO)	0	0	0	P/NP
NS 101#	National Service Scheme (NSS)	0	0	0	P/NP
					40

# Course Curriculum for B.Tech. Programme : Chemical Engineering Department

\* For students deficient in English Language

Semester	II				
Course Code	Course Name	Credit Structure			
		L	Т	Р	С
PH 102	Modern Physics	3	1	0	8
HS 102	Economics	3	0	0	6
CL 102 EE 102	Introduction to Chemical Engg ( <b>for CL</b> ) Intro. to Electrical and Electronic Circuits* ( <b>for EE and ME</b> )	3	0	0	6
MA 102 MA 104	Linear Algebra Ordinary Differential Equation - I	3 3	1 1	0 0	4 4
ME 102	Workshop Practice	0	1	3	5
CH 112	Chemistry Lab	0	0	3	3
NC 102#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 102#	National Sports Organization (NSO)	0	0	0	P/NP
NS 102#	National Service Scheme (NSS)	0	0	0	P/NP
					36

# Any one of these courses to be taken

Semester	Semester III						
Course code	Course Name	Credit structure					
		L	Т	Р	С		
CL 201	Solid Mechanics	2	1	0	6		
MA 201	Complex Analysis	3	1	0	4		
MA 203	Differential Equations - II	3	1	0	4		
CL 203	Chemical Engineering Thermodynamics	3	1	0	8		
CL 205	Introduction to Transport Phenomena	2	1	0	6		
CL 211	Introductory Chemical Lab	0	0.5	3	4		
					32		

Semester IV								
Course code	Course Name	Credit structure						
		L	Т	Р	С			
ES 202	Environmental Studies (half semester)	2	1	0	3			
HS 202	Environmental Studies (half semester	2	1	0	3			
CL 202	Fundamentals of Heat and Mass Transfer	2	1	0	6			
CL 204	Process Fluid Mechanics	2	1	0	6			
CL 206	Introduction to Numerical Analysis	3	1	0	8			
CL 212	Chemical Engineering Lab – I	0	0	6	6			
					32			
	HONORS							
CL xxx	Honors Elective	2	1	0	6			

Semester	V				
Course code	Course Name	Credit structure			
		L	Т	Р	С
EE 102	Introduction to Electrical and Electronics Circuits	3	1	0	8
BT 301	Molecular Cell Biology	2	1	0	6
HS 3xx	HSS elective	3	0	0	6
CL301	Mass Transfer Operations	2	1	0	6
CL 311	Chemical Engineering Lab-II	0	0	6	6
EE 313	Basic Electric Circuits Lab.	0	0	3	3
					35
	HONORS				
CL xxx	Honors Elective	3	0	0	6

Semester	VI					
Course code	Course Name	Credit structure				
		L	Т	Р	С	
CL 302	Chemical Reaction Engineering	3	1	0	8	
CL 304	Material Science	3	0	0	6	
XX xxx	Institute Elective – I	3	0	0	6	
EE xxx	Department Elective – I	3	0	0	6	
CL 312	Chemical Engineering LabIII	0	0	6	6	
					32	
	HONORS					
CL xxx	Honors Elective	2	1	0	6	

Semester	VII				
Course code	Course Name	Credit structure			
		L	Т	Р	С
CL 401	Process Equipment Design and Economics	3	0	0	6
CL 403	Process Control	3	1	0	8
CL xxx	Department Elective – II	3	0	0	6
XX xxx	Institute Elective – II	3	0	0	6
CL 411	Chemical Engineering LabIV	0	0	6	6
					32
	HONORS				
CL xxx	Honors Elective	3	0	0	6

Semester VIII								
Course code	Course Name	Credit structure						
		L	Т	Р	С			
CL402	Chemical Processes	3	0	0	6			
CL404	Chemical Process Design	3	0	0	6			
CL411	Design Lab I	0	0	3	3			
CL413	Design Lab II	0	0	3	3			
CL xxx	Department Elective - III	3	0	0	6			
CL xxx	Department Elective - III	3	0	0	6			
					30			
	HONORS							
CL xxx	Honors Elective	3	0	0	6			

i	Title of the Course	Cher	nistr	ſУ		Course Code	CH 101
ii	Credit structure	L 1	Т 1	P 0	C 6		L
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content Schrodinger equation (o function, Hydrogen atom: orbitals, Structure, bonding N2, O2, CO and HF, Conformation of alkanes (addition reactions, read reactions and reactivity o interconversions involving in size, electron affinity, Ellingham diagram and Transition metal chemistry bonding aspects and stru- transport proteins, Cata metathesis	rigin soluti g and Confi s and ctions of aci oxida ioniz ther ther ther ther ther ther ther ther	of con t ene gura l cy d h ation zatio gan dist hy	quar to Φ ation cloa ue alide n an phyna ic cc tortic droc	ntization), B -part, MO th levels of dia , molecula lkanes, Re to acidic p e, ester and d reduction, otential and mics in th omplexes, bo on, Bioinorg- genation, hy	orn interpretation heory: atomic and atomic molecules. r chirality and activity of carbo proton, addition- d amide), Function Periodic propert d electronegativit e extraction of ponding theories, n anic chemistry: si ydroformylation	n of wave molecular Examples isomerism, onyl group elimination onal group ies: trends ty, Use of elements, nagnetism, torage and and olefin
v	Texts/References P.W.Atkins, Physical Che G.M.Barrow, Physical Ch 1992. D.A.McQuarrie an approach, Viva Books Pvt Chemistry, Prentice Hall of Chemistry, Pearson Educ Organic Chemistry, Johr R.A.Plane, Chemical Princ Concise Inorganic Chemi Chemistry, Houghton Miffi	emistr emist d J.E . Ltd. of Ind cation wil ciples stry, 2 n Co.	y, C ry, ! 0. S ( 19 ia P and and 1th I , 198	Dxfor 5th 3imo 998 9vt. I 9vt. I 1 E 2 4 Ap Editi 84.	d University Edition, Tat n, Physical ). R.T.Morris td., 5th Ed, d, 2006. G. Gons (Asia) plications, M on, ELBS, 1	7 Press, 7th Edit a McGraw-Hill, N Chemistry - a son and R.N. Boy 1990 L. G. Wad Solomons and Pte Ltd. M.J.S McGraw Hill, 1980 1991. D.D.Ebbin	ion, 2006. New Delhi, molecular d, Organic e, Organic C. Fryhle, ienko and J. J.D.Lee, g, General
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant	All de	epar	tme	nts		

i	Title of the Course	Computer Programming and UtilizationCourse codeCS 1								
ii	Credit structure	LTPC		<u></u>						
		2026								
iii	Prerequisite, if any(for the students)	High School Mathematics								
iv	Course Content									
	<u>Description:</u> This course provides provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include:									
	<ul> <li>A. Utilization: Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries.</li> <li>B. Programming features: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o.</li> <li>C. Sample problems in engineering, science, text processing, and numerical methods.</li> </ul>									
V	Texts/References									
	1. G. Dromey, How t Saddle River, NJ,	o Solve It by Computer, Prentice-H 1982	all, Inc., U	pper						
	2. Polya, G., How to	solve It (2nd ed.), Doubleday and	co. (1957).	ı						
	<ol> <li>C++ Program Des Oriented Design. 2003.</li> </ol>	sign: An introduction to Programmir Tata McGraw Hill. Coohoon and Da	וg and Obj avidson. 3 <sup>r</sup>	ect- <sup>d e</sup> dition.						
	4. Let`s C. Yashwan	t Kanetkar. Allied Publishers, 1998								
	5. The Java Tutorial	, Sun Microsystems. Addison-Wesl	ey, 1999.							
vi	Instructor(s)name									
vii	Name of other departments to whom the course is relevant	All Department n t								

i	Title of the Course	Economi	CS	Course Code	HS 102
ii	Credit structure	L T P 3 0 0	C 6		
iii	Prerequisite, if any(for the students)	None			
iv	Course Content Basic economic problems Nature of Economics: macroeconomics, Basic economic activity; market India. Theory of utility and market equilibrium. Theor Perfect and imperfect of macroeconomics, measu Consumption, savings, a Relationship between r consequences and rem balance payments, stability policies.	s. Resourd Positive concepts t and gov consume ries of firm competitio urement und invest money, c edies. Int zation pol	ce constraints an and normative in economics. T ernment failures; r's choice. Theori n, production and n, oligopoly, mo and determination ments. Commerco output and price ernational trade, icies : Monetary,	d Welfare max economics; I The role of the New Economic es of demand, s costs. Market mopoly. An ow on of nationa cial and centra es. Inflation foreign exch Fiscal and Excl	imizations. Micro and e State in c Policy in supply and structures. verview of l income. l banking. - causes, lange and hange rate
V	<ol> <li>Texts/References</li> <li>P. A. Samuelson 1995.</li> <li>A. Koutsoyiannis Pindyck and D. I company, NY, 198</li> <li>R. J. Gordon, N Boston, 1987. Wil</li> <li>The Organization</li> </ol>	& W. D. , Moderr Rubinfe 9. lacroecon liam F. Sh of Industr	nordhaus, Econ Microeconomic Id, Microeconom omics 4th editior ughart II, y, Richard D. Irwir	omics, McGrav s, Macmillan, ics, Macmillan n, Little Brown n, Illinois, 1990.	w Hill, NY, 1975. R. publishing and Co.,
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant	All Depar	tments		

i	Title of the Course	Cal	culu	s		Course code	MA 101			
ii	Credit structure	L	Т	Ρ	С					
		3	1	0	8					
iii	Prerequisite, if any(for the students)	Nor	ne							
iv	Course Content									
	Review of Limits, continuit	ty, di	ffere	entia	bility.					
	Mean value theorem, Tayl	lors <sup>-</sup>	Theo	oren	n, Maxima and M	linima.				
	Riemann integrals, Fund applications to area, volur	dame ne	ental	the	eorem of Calcu	ılus, Improper	integrals,			
	Convergence of sequence	es ar	nd se	eries	s, power series.					
	Partial Derivatives, gradie minima, Lagrange multipli	ent ar iers.	nd d	irect	tional direvatives	s, chain rule, m	axima and			
	Double and Triple integrat	tion,	Jaco	obia	ns and change o	of variables for	mula.			
	Parametrization of curve integrals.	es a	Ind	surf	aces, vector F	ields, Line ar	nd surface			
	Divergence and curl, Theo	orem	ns of	Gre	en, Gauss, and	Stokes.				
v	Texts/References									
	<ol> <li>Hughes-Hallett et John-Wiley and S</li> </ol>	t al, Sons	<i>Calo</i> (200	culus 03)	s – Single and N	Multivariable (3	<sup>rd</sup> Edition),			
	2. James Stewart, C	Calcu	lus (	5 <sup>th</sup> E	Edition), Thomso	on (2003)				
	3. T.M. Apostol, <i>Cal</i> 1980	lculu	<i>s</i> , V	olun	nes 1 and 2 ( $2^n$	<sup>d</sup> Edition), Wile	ey Eastern			
	4. G.B.Thomas and Edition), ISE Rep	IR.L	Fir Addi	iney son	, <i>Calculus and</i> -Wesley, 1998.	Analytic Geo	ometry (9 <sup>th</sup>			
vi	Instructor(s)name									
vii	Name of other departments to whom the course is relevant	All Departments								

i	Title of the Course	Ele	ctric	ity a	ind M	agnetism		Course code	PH 101
ii	Credit structure	L 2	Т 1	P 0	C 6				
iii	Prerequisite, if any(for the students)	No	one						
iv	Course Content Electrostatics : Coulomb' equation, Poisson's equ dielectrics. Magnetostatics Magnetic Induction : Fara energy in a magnetic fie displacement current, e Maxwell's equations, Poy reflection, refraction, abso	's la uatio s : E ada eld, elec untir orptio	aw, ( on, 3iot S LCI trom ng ve on a	Gau elec Sava aw, R ci agn ector nd s	ss th trosta rt's la Lenz rcuit, etic r, way kin de	eorem, ele atics with w, Ampere' 's law, self resonance waves, pla ve propagat epth.	ctric p condu s law, and e. Max ane v tion th	ootential, uctors, c Lorentz f mutual ir xwell's eq vave sol arough a	Laplace's capacitors, orce. nductance, quations : lutions of boundary,
V	Texts/References 1. A.S. Mahajan ar McGraw Hill, 1989 2. D. Griffiths, Introd 1989.	nd / 9. duc	A. R tion	lang to E	awala Electr	a, Electricit odynamics,	y and 2nd	I Magnet ed., Prer	ism, Tata ntice Hall,
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant	All	depa	artm	ents				

i	Title of the Course	Chemistry Lab	Course code	CH 112
ii	Credit structure	LTPC		
		0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Experiments illustrating the co cells, (2) thermochemistry, (3 (4) equilibrium constant, (5) a reduction titration.	ncepts of 1) 3) chemical analysis by	) galvanic kinetics, oxidation
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Engineering Graphics and Course code ME Drawing							
ii	Credit structure	L	Т	Ρ	С		L	I	
		0	1	3	5				
iii	Prerequisite, if any(for the students)	Nor	ne						
iv	Course Content								
	Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections. v								
v	Texts/References								
	Bhatt N. D. and Panchal V. M., Engineering Drawing, Charotar Publishers Anand, 2007. Luzadder Warren J. and Duff Jon M., Fundamentals of Engineering Drawing, Prentice Hall of India, 2001. French Thomas E. and Vierck Charles J., Engineering Drawing and Graphic Technology, McGraw Hill, 1993. Jolhe Dhananjay A., Engineering Drawing, Tata McGraw Hill, 2007 Shah M. B. and Rana B. C., Engineering Drawing, Dorling Kindersley (India Pvt. Ltd, Pearson Education,								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Mod	ern	Pł	nysics	Course Code	PH 102		
ii	Credit structure	L T 3 1	F 0	)	C 8				
iii	Prerequisite, if any(for the students)	None	9						
iv	Course Content								
	Special theory of relativity: Galilean and Lorentz transformation, space time viewpoints, Minkowski space and four vectors, energy momentum conservation. Review of quantum concepts, Black body radiation, particle nature of light, photoelectric effect, Compton effect, matter waves, wave packets, phase and group velocity, Davisson Germer experiment, Franck-Hertz experiment, Heisenberg uncertainty principle. Schrödinger equation, probabilistic interpretation of wave function. One dimensional problems-particle in a box, potential well, potential barrier and tunneling, harmonic oscillator. Hydrogen atom. Elements of statistical Physics: Maxwellian distribution, Bose-Einstein and Formi Dirac distributions								
V	Texts/References								
	<ol> <li>H.S. Mani and G.H</li> <li>S.H. Patil, Elemer</li> <li>K.S. Kane, Moder</li> <li>A. Beiser, Concept</li> </ol>	K. Mehta, Introduction to Modern Physics. ents of Modern Physics. ern Physics epts of Modern Physics							
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant	All D	epa	rtı	ments				

i	Title of the Course	Intro	ducti	on te	o Philosoj	phy	Course Code	HS 103
ii	Credit structure	L T 3 0	P 0	C 6				
iii	Prerequisite, if any(for the students)	None	!					
iv	Course Content							
	The course will acquaint issues on the nature an ethical issues arising of The objective is to deve the issues relating to the f Growth of scientific kno science. Conceptual evo science: induction, falsifi scientific laws and theorie Relationship between s Nature of scientific explan model. Selected case st mathematical reasoning: axioms: formal axiomatic completeness. Nature of axiomatic systems and pri understanding of mind behaviourist and cognitiv and society: elements of e	the s d me but c elop follow wledg lution cation cation cation syste rules oof pr and vist. E enviro	tuden thods f th a crit ng to je: fa intenism, alism, alism, ic ob tize a of ir oced me thics: nme	ts of of cal, pics: actors rnal cologi scien and c Conc ferer ures. ntal lm ttal a	science a science plication reflective a Philosoph leading tr and extern firmation trumentalis ation, experience cal explar tific theoric leductive f cept of corn ce and p Cognition processe pact of scient	and of s and h y a o the nal h sm a erime natior ies.L orms natior ies.L orms siste roof. : Cu ence sional	engineering w mathematics, cience and te nistorical aware nd History of e emergence o istory. Metho d probability. nd under dete ent and scienti as and the cov ogic and the of reasoning. ency, independ Selected exa urrent approact empiricist, r and technolog ethics.	ith some and the echnology. eness on Science: f modern dology of Nature of Nature of rmination. fic theory. vering law nature of Nature of lence and amples of hes to the ationalist, y on man
V	Texts/References							
	A.C. Grayling (Ed.) Ph University Press, Londow of Scientific Thought: Macmillan, London 1968 Books, 1985.H. Eves a Concepts of Mathematic and K.M. Sayre (Eds.) E Dame Press, London, Scientific Method, Science of Bombay Press 1980.	<ul> <li>hilosophy; A Guide through the subject, Oxford wn, 1995.Marx W. Wartofsky, Conceptual Foundations An Introduction to the Philosophy of Science, 8.I.B. Cohen, The Birth of a New Physics, Penguin and C.V. Newsom, Foundations and Fundamental ics, Boston, PWS-Kart Pub. Co., 1990.K.E. Goodpaster Ethics and Problems of 21st Century, Univ. of Notre 1979.S.D. Agashe, A.Gupta and K. Valicha (Eds.) ace, Technology and Society: A Book of Readings, Univ.</li> </ul>						
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	All D	eparti	nent	S			

i	Title of the Course	Introdu Engine	ictic erii	on to Chemical ng	Course code	CL102			
ii	Credit structure	LT	Ρ	С					
		30	0	6					
iii	Prerequisite, if any(for the students)	None							
iv	Course Content								
	Historical overview of Chemical Engineering: Concepts of unit operations and unit processes, and more recent developments, Features of organized chemical processing - from chemistry to chemical engineering. The Chemical Industry- scope, features and characteristics and scope. Principles of balancing with examples to illustrate differential and integral balances lumped and distributed balances. Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge and bypass. Properties of substances: single component and multicomponent, single and multiphase systems. Use of Compressibility charts, vapor pressure correlations / charts & Psychometric charts. Ideal liquid and gaseous mixtures. Energy balance calculations in simple systems. Introduction to Computer aided calculations – steady state material and energy balances.								
V	Texts/References								
	1. R.M.Felder and R. Processes, 3 <sup>rd</sup> ed., Jo	W.Rou hn Wile	sse əy, l	au, Elementary P New York, 2004	rinciples of	Chemical			
	2. D.M.Himmdlblau and Chemical Engineering	d J.B.F g, 7 <sup>th</sup> ec	Rigg I., F	gs, Basic Principle Prentice Hall, 2003.	s and Calci	ulations in			
	3. B.I.Bhatt and S.M.Vora	ra, Stoichiometry, 4 <sup>th</sup> ed.McGraw Hill, 2004							
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of	the Course	Lin	ear	Alge	bra	Course Code	MA 102		
ii	Credit s	structure	L	Т	Ρ	С		1		
			3	1	0	4				
iii	Prereque the stud	uisite, if any(for dents)	No	ne						
iv	Course	Content								
	Vectors set of v	in R <sup>n</sup> , notion of lir ectors, vector subs	nea pao	r ind ces (	depe of R <sup>r</sup>	ndence and d , basis of a ve	lependence, linear ector subspace.	r span of a		
	•	Systems of Linea space, null space,	ar an	ation, row						
	•	Determinants and	rar	nk of	fam	atrix in terms	of determinants.			
	•	Abstract vector transformation, ch	spaces, linear transformations, matrix of a line hange of basis and similarity, rank-nullity theorem.							
	•	Inner product sp projections and le	oace ast	es, squ	Gra ares	m-Schmidt pr approximatio	rocess, orthonorm n.	nal bases,		
	•	Eigenvalues and of special matrice symmetric, norma by similarity tran matrices, application	eig es I). A nsfo ions	enve (orth Algel orma s to o	ector nogo braic tions quac	s, characteris nal, unitary, h and geometr s, spectral th Iratic forms.	tic polynomials, e nermitian, symme ic multiplicity, diag neorem for real	igenvalues tric, skew- onalization symmetric		
V	Texts/R	eferences								
	1.	H.Anton, <i>Element</i> Wiley (1995)	tary	' lin	ear	algebra with	applications (8 <sup>th</sup>	ed.), John		
	2.	G.Strang, Linear a	lge	bra	and	its application	s (4rh Ed.), Thoms	son (2006)		
	3.	S.Kumaresan, <i>Lin</i> India (2000)	ieai	r alg	ebra	n – A Geometr	<i>ic approach</i> , Pren	tice Hall of		
	4.	E.Kreyszig, <i>Adva</i> (1999)	anced Engineering Mathematics (8 <sup>th</sup> Ed.), John Wile							
vi	Instruct	or(s)name								
vii	Name of departn the cou	of other nents to whom rse is relevant	ner s to whom s relevant							

i	Title of the Co	urse	Oro Equ	dina uatio	ry D ons	)ifferer - I	itial	Course code	MA 104	
ii	Credit structur	е	L	Т	Ρ	С				
			3 1 0 4							
iii	Prerequisite, i the students)	f any(for	No	ne						
iv	Course Conte	nt								
	<ul> <li>Exact</li> </ul>	equations, i	nteg	grat	ing	factors	and Bernou	Illi equations.		
	Orgho	gonal trajec	torie	es.						
	<ul> <li>Lipsch</li> </ul>	nitz condition	n, Pi	icar	d's t	heore	m, examples	on nonunique	eness.	
	Linear	<sup>r</sup> differential	equations generalities.							
	Linear	dependenc	ce and Wornskians.							
	Diame	ensionality o	f sp	ace	of s	solutio	ns, abel-Liou	ville formula.		
	Linear	ODE's with		nsta	nt c	oeffici	ents, the cha	iracteristic equ	ations.	
	<ul> <li>Cauch</li> </ul>	ny-Euler equ	atio	ons.						
	<ul> <li>Method</li> </ul>	d of undete	rmir	ned	coe	fficient	S			
	<ul> <li>Method</li> </ul>	d of variatio	n of	f pa	ram	eters.				
	<ul> <li>Laplace</li> </ul>	ce transform	is ge	ene	raliti	es.				
	<ul> <li>Shiftir</li> </ul>	g theorems								
	Convo	olution theor	em.							
V	Texts/Referen	ces								
	1. E.Kre (1999	yszig, <i>Adva</i> )	nce	d e	ngir	neering	n mathemati	<i>cs</i> (8 <sup>th</sup> Ed.), J	lohn Wiley	
	2. W.E.E John	Boyce and F Wiley (2005	R. Di 5)	iPrir	na,	Eleme	entary Differe	ential Equatior	<i>ns</i> (8 <sup>th</sup> Ed.)	
	3. T.M.A	postol, <i>Calc</i>	alculus, Volume 2 (2 <sup>nd</sup> Ed.), Wiley Eastern, 1980.							
vi	Instructor(s)na	ime								
vii	Name of other departments to the course is r	o whom elevant								

i	Title of the Course	Wo	orksl	nop	Practice	Course Code	ME 102
ii	Credit structure	L	Т	Ρ	С		
		0	1	3	5		
iii	Prerequisite, if any(for the students)	No	ne				
iv	Course Content						
	Introduction to wood wor pattern making: types of p bench work & fitting: too machine tools: Safety me like lathe, shaping, & drill tools and their usage, se welding. Assignments: Sir welding, lathe and shaping	rk: ols asu ing. elec nple g m	han erns, & c res, Imp tion e as achi	d to allo prin oort of sigr	ools & various owances, colou rations. Introdu nciples of oper ant operations cutting speeds ments in wood work.	a operations. In ur coding. etc. In uction to metal ration of basic m on these mach s, feeds, etc. In d working, fitting	troduction to itroduction to cutting and nachine tools ines. Cutting troduction to j, electric arc
v	Texts/References						
	1) Elements of Worksho	рТe	echr	nolo	gy, Vol. I by S.	К.	
	Hajrachoudhury & Oth	ners	s, Me	edia	a Promoters an	d Publishers,	
	Mumbai. 14th Edition,	, 20	07.				
	2) Elements of Worksho	рТе	echr	olo	gy, Vol. II by S	. K.	
	Hajrachoudhury & Oth	ners	s, Me	edia	a Promoters an	d Publishers,	
	Mumbai. 12th Edition,	200	)7.				
	3) Workshop Practice by	Н.	S. B	lawa	a, Tata-McGrav	w Hill, 2004.	
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant	All	Dep	parti	ments		

i	Title of the Course	Ph	ysic	s L	ab.	Course code	PH 111		
ii	Credit structure	L	Т	Ρ	С				
		0	0	3	3				
iii	Prerequisite, if any(for the students)								
iv	Course content								
	Error analysis and accuracy of measurement.								
	Selected experiments from the following:								
	current and voltage sensit self inductance using And coil. Fresnel biprism, New physical pendulum, Kundt Counter.	itivities of a moving coil galvanometer, measurement of nderson's bridge, resistivity of a thermistor, Helmholtz ewton's rings. Young's modulus using Koenig's method, dt's Tube, Laser Diffraction, Grating Spectrometer, G.M.							
v	Texts/References								
	<ul> <li>B.L. Worsnop and Asia Publishing H</li> </ul>	l H. ous	T. F se, 1	lint, 971	Advanced Pra	ctical Physics fo	r students,		
	G.L. Squires, Univ	/ers	ity F	Pres	s, Cambridge,	1999.			
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Solid Mechanics	Course Code	CL 201
ii	Credit structure	LTPC		
		2 1 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content			
	Rigid and deformable so bodies – review of free stresses; State of stress strain; Hooke's Law; Co deflections; Indetermin indeterminate systems a in cylindrical and sphe circular shafts – determ bending of beams; She shearing stresses in bea and shear center; Princi plane stress and strain deflection of beams by o method of to simple in members.	blids; Method of sections for body diagrams; Concept c; Concept of strain – norm onstitutive relations; Axially ate systems and comp and lack of fit problems; G rical shells; Thin-Walled I inate and simple determina- ter force and bending more ams of symmetrical cross-se ple of superposition and it ; Principal stresses and se lirect integration method, A determinate systems. Ela	or evaluating inte of stress – norm nal and shear stra / loaded membe patibility condition eneralized Hook Pressure Vessels ate systems. Ela ment diagrams; section; Concept limitations. Trans trains; Mohr's cirr opplication of dire stic buckling of	rnal forces in al and shear ains; State of rs, force and ons; Simple s law; Stress s; Torsion of stic theory of Bending and of shear flow sformation of rcle. Bending ct integration compression
v	Texts/References			
	1. F.P.Beer, E.R.Jo Tata McGraw Hi	hnston and J.T.DeWolf, M II, New Delhi, 2004	echanics of Mate	rials, 3 <sup>rd</sup> Ed.,
	2. E.P.Popov, Engi Delhi, 1999	neering Mechanics of Solid	ds, 2 <sup>nd</sup> Ed., Prent	ice Hill, New
	3. I.H.Shames and Ed. Prentice Hill	J.M.Pitarresi, Introduction , New Delhi, 1989.	to the Solid Mec	hanics, 3 <sup>rd</sup>
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Complex Analysis	Course Code	MA 201				
ii	Credit structure	L T P C 3 1 0 4						
iii	Prerequisite, if any(for the students)	Nil						
iv	<ul> <li>Course Content</li> <li>Definition and properties of analytics functions.</li> <li>Cauchy-Riemann equations, harmonic functions.</li> <li>Power series and their properties</li> <li>Elementary functions</li> <li>Gauchy's theorem and its applications.</li> <li>Taylor series and Laurent expansions.</li> <li>Residues and the Cauchy residue formula</li> <li>Evaluation of improper integrals</li> <li>Conformal mappings</li> <li>Inversion of Laplace transforms</li> </ul>							
V	<ul> <li>Texts/References</li> <li>1. R.V.Churchill and J.W.Brown, Complex variables and applications (7<sup>th</sup> Edition), McGraw-Hill (2003)</li> <li>2. J.M.Howie, Complex analysis, Springer-Verlag (2004)</li> <li>3. M.J.Ablowitz and A.S.Fokas, Complex Variables 0 Introduction and Applications, Cambridge University Press, 1998 (Indian Edition)</li> <li>4. E.Kreyszig, Advanced Engineering Mathematics (8<sup>th</sup> Edition), John Wiley (1999)</li> </ul>							
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Differential Equations - II	Course Code	MA 203			
ii	Credit structure	L T P C 3 1 0 4					
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content Review of power s Legendre's equat Regular and irreg Bessel's equation Strum-Liouville pr Fourier series D'Alembert solutio Classification of li Vibration of a circo Heat equation in t	series and series solutions of ODE's tion and Legendre polynomials gular singular points, method of Frobenius n and Bessel's functions roblems ion to the Wave equation. linear second order PDE in two variables cular membrane the half space.					
v	<ul> <li>Texts/References</li> <li>1. E.Kreyszig, Advanced Engineering Mathematics (8<sup>th</sup> Edition), John Wiley (1999).</li> <li>2. W.E.Boyce and R.Diprima, Elementary Differential Equations (8<sup>th</sup> Edition), John Wiley (2005).</li> <li>3. R.V.Churchill and J.W.Brown, Fourier series and boundary value problems (7<sup>th</sup> Edition) McGraw-Hill (2006).</li> </ul>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Chemical Engineering Thermodynamics	Course Code	CL 203
ii	Credit structure	LTPC		
		3 1 0 8		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content			
	Single-Phase Systems; Irreversible Processes; E Law : Closed and Open S and Entropy: Reversible Maxwell Relations and F Equilibria, Power and Mechanics Basics: quantu theorem, micro canonical, partition function and the gases, lattice statistics, in solution theories. Single F molar quantities; Gibbs- criteria, non ideal solution Activity Coefficient mode pressures; Raoult's Law, I processes LLE, Triangular Reaction Equilibrium: H reaction Equilibrium: H reaction Equilibria; Com	Introductory concepts; Wo quations of State and Gen systems, Steady and Transi e Heat Engines; Availabili Fluid Properties Estimation Refrigeration Cycles; Flourn states and degeneracy of canonical, grand canonical ermodynamic properties; in deal gas mixtures, imperfer Phase Mixtures and Solution Duhem Equation; Phase ons, residual and Excess and solution Henry's law High-Pressure ar diagrams. Langmuir and lomogeneous and Heteron abined Phase and React ters, Osmometers and their	ork, Heat, Reve ent Processes. ity and Exergy ity and Exergy ow Processes; of energy levels. al and the other mono atomic ar ect gases; liquid ons; Ideal Soluti e-Rule; Phase s properties; Fu (VLE) at low to VLE Availability d BET isotherms ogeneous react tions Equilibria; r Principles.	ersible and ations; First Second law <sup>7</sup> Analyses, nent Phase Statistical Louisville's ensembles, nd diatomic d state and ons; Partial equilibrium ugacity and b moderate Analysis of s; Chemical tions; Multi
V	<ol> <li>J.M.Smith,H.C. Va Engineering Thern</li> <li>S.I.Sandler, Chern 4<sup>th</sup> Ediction, Wiley</li> <li>J.M.Prausnitz, R.I Thermodynamics</li> <li>J.W.Tester and M Prentice Hall, 199</li> <li>R.C.Reid., J.M.Pr Liquids, 4<sup>th</sup> ed., M</li> <li>R.Balzheiser, M.S Thermodynamics, 7 K Denbigh, Princip</li> </ol>	an Ness and M.M.Abbott. In modynamics, 6 <sup>th</sup> ed., McGra nical, Biochemical and Engi India, 2006. N.Lichtenthaler and E.G.Aze of Fluid-Phase Equilibria, 3 Modell, thermodynamics an 9. ausnitz and B.E.Poling, Pro c-Graw-Hill, 1987. Samuels and J.Eliassen, Ch , Prentice Hall, 1972.	ntroduction to Ch aw-Hill,2001 ineering thermod evedo, Molecula <sup>3<sup>rd</sup> Ed. Prentice H nd its Application operties of Gase emical Engineer m 4<sup>th</sup> ed CPU</sup>	nemical dynamics, ar Hall, 1998. ns, 3 <sup>rd</sup> ed. s and ring 1081
vi	Instructor(s)name		,,,	
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Introduction to Transport Course CL 205 Phenomena Code					
ii	Credit structure	LΤ	Ρ	С			
		2 1	0	6			
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content						
	Introduction: Vectors/Tens Equations of Change for Substantial derivatives; U film, Couette viscometer, Parallel plates, Oscillating transport; Shell energy bal flow; The equations of mechanisms of mass transp Equations of change for m and mass transfer coefficier	ors, Visc or isoth nidirectio Rotating plate; ances ar change bort; Con ulticomp nts.	cosi lern ona g S The nd t for cen one	ty, Shell balance: F nal systems: Cor I flows: Pipe flow, Sphere; Unsteady flo ermal conductivity a emperature distributi nonisothermal syst tration distributions i ent systems; Introduc	alling film, atinuity, M Variable v ows: Start and mechar ons in soli- ems; Diffu n solids an tion to the	Circular tube; otion, Energy, iscosity falling tup Plate flow, nism of energy ds and laminar sivity and the d laminar flow; concept of heat	
v	Texts/References	1.	R. Tr	B.Bird, W.E. Stewart ansport Phenomena,	and E.N. L 2nd ed., W	lightfoot, iley, 2006.	
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Introductory Chemical Lab. (DIL)	Course Code	CL 211
ii	Credit structure	L T P C 0 0.5 3 4		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Will be provided by the Lab Inst	ructor	
v	Texts/References	As given by Lab Instructor		
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Env	vironi	men	tal Stu	dies	Course Code	ES 202
ii	Credit structure	L	Т	Ρ	С	(Half	semester course	e)
		2	1	0	6			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Multidisciplinary nature of conservation, Indicators of er	envi nviroi	ronm nmer	ienta Ital p	l stud ollutior	ies, Ecos 1, Environ	systems, Biodiver ment and human I	sity and its nealth
	Consumption of natural resources and environmental degradation (forests, water, coal, minerals, energy, and land), Sustainable development, Environmental policy and legislation, Environmental impact assessment.							
	Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems, Solid and hazardous waste management (causes, effects and control measures)							
	Air and noise pollution (sc including climate change, g hazards, Disaster managem landslides),	ience globa ent (	e and al wa (indu:	d en Irmin strial	gineeri g, acio accide	ng of po d rain, o ents, flood	llution control), G zone layer deple ds, earthquakes, d	ilobal Issues tion, nuclear cyclones and
v	Texts/References							
	Cunningham W.P. and Cun Tata McGraw-Hill Publishing	ningh Com	nam pany	M.A. , Nev	(2002 v Delhi	), Princip	les of Environme	ntal Science,
	Nathanson, J.A. (2002), Ba Delhi.	sic E	Enviro	onme	ental T	echnology	y, Prentice Hall o	f India, New
	Arceivala, S.J. and Asolekar, Reuse, 3rd Edition, Tata McG	S.R. àraw	(200 Publ	)6), ishin	Wastev g Co. L	vater Trea .td., New	atment for Pollution Delhi.	n Control and
	Asolekar, S.R. and Gopichan Indian Perspective, Foundati	idran on Bi	, R. ( ooks	2005 Pvt.	5), Prev Ltd., N	ventive Er ew Delhi,	vironmental Mana 2005.	igement – An
	Some selected book-chapter	s, mo	onogi	raph	s and jo	ournal pap	oers	
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	All c	depa	rtme	ents			

i	Title of the Course	Env	rironı	men	tal St	udies	Course Code	HS 202
ii	Credit structure	L	Т	Ρ	С	(Half s	emester course	)
		2	1	0	6			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Social Issues and the Indicators of sustainability resources: issues and ma	envi y, G nage	ronm over emer	nent, nand nt.	, Pu ce of	blic awar Natural	eness and Hu Resources - Co	man rights, mmon pool
	Environmental ethics, Re Trends, Environmental Bioregionalism, Environme	eligio mov ental	n ai veme I just	nd e ents ice.	enviro an	onment, V d Activis	Vilderness and m, Social Ec	Developing ology and
	Environmental economics, Trade and environment, Economics of environmental regulation, Natural resource accounting, Green GDP.							
	Environment and develo Impacts of climate change to climate change.	and development, Resettlement and rehabilitation of people, nate change on economy and society, Vulnerability and adaptation nge.						
V	Texts/References							
	Agar, N., 2001. <i>Life's Intrii</i>	nsic	Valu	<i>e</i> , N	ew Y	ork: Colun	nbia University F	ress.
	Dasgupta, P. and Maler, G Development Issues, Vol.	i. (ed I, Ol	ls.), JP.	(199	7), T	he Enviro	nment and Emer	rging
	Guha, Ramachandra (200 <i>Debating on Gandhi</i> , in A Press.	)6):" A. Ra	Mah aghu	atar Iram	na G arajı	andhi and ı (ed.), Ne	Environmental ew Delhi: Oxforo	Movement," d University
	Guha, Ramachandra and and Abuse of Nature in Co	Mao onter	dhav npor	' Ga 'ary	dgil India	(1995): Ec , New Del	cology and Equit hi: Penguin.	ty: The Use
	Hanley, Nick, Jason F. Economics in Theory and	Sh Prac	nogre ctice,	en a , Nev	and w De	Ben Wh Ihi: MacM	ite (2004): En illan.	vironmental
	Naess, A. and G. Ses <i>Ecophilosophy</i> , Vol.6.	sion	s (1	984	): "E	Basic Prir	nciples of Deep	o Ecology,"
	Redclift, M. and Woodgate Environmental Sociology,	e, G. Edw	(eds ard I	s.), ( Edga	1997 ar.	), Interna	tional Handbook	of
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	AII [	Depa	artme	ents			

i	Title of the Course	Fundamentals of Heat and Mass Transfer	Course Code	CL 202
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content Review of conduction, res Introduction to Convection correlations; Radiation; Hea mass transfer, mass transfe mass transfer coefficient, con heat and mass transfer, Crystallization.	istance concept, extended surfaces, la , boundary layer theory, natural and at exchangers: LMTD, epsilon-NTU m r coefficient, theories for interphase ma relations, mass transfer with chemical re analogy between momentum, heat a	umped cap forced co nethod; In- ass transfe action, sim and mass	pacitance; privection, terphase r, overall ultaneous transfer;
V	<ol> <li>Texts/References</li> <li>F.P. Incropera and D.</li> <li>E.L. Cussler, Diffusi</li> <li>R.B. Bird, W.E. Stev Wiley, 2006.</li> </ol>	P. Dewitt, Introduction to Heat Transfer, 5 on: Mass Transfer in Fluid Systems, 2nd vart and E.N. Lightfoot, Transport Phenor	oth ed., Wild ed., CUP, 1 nena, 2nd e	ey, 2006. 997. ed.,
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Pro	ces	s Fl	uid Mechanics	Course Code	CL 204	
ii	Credit structure	L	Т	Ρ	С			
		2	1	0	6			
iii	Prerequisite, if any(for the students)							
iv	Course Content							
	Basic Fluid Concepts: Dir and surface tension, Nonr theorem), Types of flows, Review of NSE, Potent (Laminar), Viscous flows Momentum (Impinging jet charts); Chem Engg Equi immersed objects (Packed t filtration), Pumps, Agitatio up), Particulate solids, cha (Reynolds equations), Com	pts: Dimensions and Units, Velocity and Stress Fields, Viscosity n, Nonnewtonian viscosity, Dimensional Analysis (Buckingham PI flows, Methods of Analysis, Fluid Statics; Differen- tial Analysis: Potential flows, Velocity potential, Boundary Layer Theory flows (past sphere), Integral Analysis: Mass, Energy (Bernouli), ging jet, pitot tube, Orifice meter, rotameter, pipe flow: f vs Re gg Equipment: Piping systems (K factors, networks), Flow past Packed beds, Fluidised beds, sedimentation, Centrifugal separation, Agitation and Mixing, (Power consump- tion, mixing times, scale ids, characterisation, Other topics: Introduction to Turbulent Flows s), Compressible flows, Compressors.						
v	Texts/References							
	1. 1. R.W. Fox, A.T. M Mechanics Wiley,	/lacE 2008	)ona 8.	ald a	and P.J. Pritchard, Introduct	ion to Fluid		
	2. J.O. Wilkes, Fluid M CFD, 2nd ed., Pre	Mech entice	anio e Ha	cs fo all, f	or chemical engineers with 1998.	microfluidics	and	
	3. M.Denn, Process Fl	uid l	Mec	han	ics, Prentice Hall, 1979.			
	4. 4. V.Gupta and S.K	. Gu	ipta,	Flu	id Mechanics and its appli	cations, Wiley	<i>ı</i> , 1984.	
	5. R.B. Bird, W.E. Ster Wiley, 2006.	wart	and	E.ľ	N. Lightfoot, Transport Phe	nomena, 2nd	ed.,	
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Introdu Analysi	ucti is	on to Numerical	Course Code	CL 206		
ii	Credit structure	LT	Ρ	С				
		3 1	0	8				
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Interpolation by polynomials piecewise linear and cubic serror formulae. Solution of elimination and Gauss-Sei factorization Cholesky's m equation, bisection and seca of a system of nonlinear equ Euler and Runge-Kutta meth of convergence, finite differ hyperbolic partial differentia Gershgorin's theorem. Expos	ials, divided differences, error of the interpolating polynomial, ic spline interpolation. Numerical integration, composite rules, of a system of linear equations, implemen- tation of Gaussian Seidel methods, partial pivoting, row echelon form, LU method, ill-conditioning, norms. Solution of a nonlinear ecant methods. Newton's method, rate of convergence, solution equations, numerical solution of ordinary differential equations, nethods, multi-step methods, predictor-corrector methods, order fference methods, numerical solutions of elliptic, parabolic, and ntial equations. Eigenvalue problem, power method, QR method, posure to software packages like IMSL subroutines, MATLAB.						
v	Texts/References							
	1. S.D. Conte and C. de Approach, 3rd ed., McGr	Boor, El 'aw-Hill	em , 19	entary Numerical Analysis- 80.	An Algorit	hmic		
	2. C.E. Froberg, Introdu	ction to	Nu	merical Analysis, 2nd ed., A	Addison-W	esley, 1981.		
	3. E. Kreyszig, Advance	engine	eeri	ng mathematics, 8th ed., Jo	ohn Wiley (	1999).		
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Che	Chemical Engineering Lab I					Course Code	CL 212
ii	Credit structure	L	Т	Ρ	С				1
		0.5	0	2	3				
iii	Prerequisite, if any(for the students)								
iv	Course Content	(Focus: Fluid Mechanics, Thermodynamics) Experiments on the flow through piping networks, Nature of flow, Venturi / Orifice meter, Stokes Law, pumps in series / parallel, determination of partial molar enthalpies, vapour pressures, infinite di- lution activity coefficient, vapour- liquid equilibrium, adiabatic calorimetry, size reduction (ball mill), porosity measurement							
v	Texts/References	As p	orovi	ded	by l	_ab Inst	ructo	r	
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								
i	Title of the Course	Introduction to Electrical and Electronic Circuits	Course Code	EE 102					
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ii	Credit structure	LTPC							
		3 1 0 8							
iii	Prerequisite, if any(for the students)	Nil							
iv	Course Content								
	Introduction, basic physical laws, circuit elements, KVL, KCL, and a few important circuit theorems, simple circuits, Transients in R-L, R-C, L-C Sinusoidal Steady State, Real/Reactive Power, three phases. Working Principles of Transformers / AC / DC machines. Functional Characteristics of Diode, BJT, OP-AMP, Analog circuit Examples: rectifiers, amplifiers, oscillators etc. Digital Circuits: AND/OR grates, Flip Flops, DAC /ADC etc.								
v	Texts/References								
	1. Vincent Del Toro,	Electrical Engineering Fundamer	ntal, Printice	e Hall, 1989					
	<ol> <li>K.A.Krishnamurthy and M.R.Raghuveer, Electrical and Electronics Engineering for Scientists, Wiley Eastern Ltd., 1993</li> </ol>								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Molecula	r Cell Biology	Course Code	BT 301
ii	Credit structure	L T P 2 1 0	C 6		
iii	Prerequisite, if any(for the students)	Nil			
iv	Course Content Biology and Bioprocess, Classification of microorg bacterial cell. Organizati chemical composition, fur proteins, carbohydrates, and nitrogen cycle in natu energy in biology. Singl receptor interactions. In replication, RNA transcr inheritance: chromosome diseases in humans. Sp immune system	Relevand ganisms a on of pla nction, Bic ipids and ure, metal e transdu formation iption, ge s, Mende ecial topi	ce to society. Proca and important cell t int and animal cells molecules : propertion nucleic acids. Cell polic grid, glycolysis. action, receptor con transfer in cells: netic code and tra l's laws, phenotype cs : Genetic engine	aryotes and types. Structu s, organelles es of water a lular processo TCA cycle a iccept, nature Central do anslation. Ge and genoty eering, Cell o	eucaryotes. ures of the , structure, mino acids, es : carbon nd forms of of ligand- gma, DNA enetics and pe, genetic culture and
v	Texts/References				
	<ol> <li>B.Alberts, D.Bray, J.Lewis, M.Raff,K.Roberts and J.D.Watson, Molecula Biology of the Cell. Garland Publishing, Inc 2<sup>nd</sup> edition, 1989.</li> <li>E.J.Gardner, M.J.Simons and D.P.Snustad, Principles of Genetics, John Wiley and Sons, 8<sup>th</sup> edition, 1991</li> <li>D.Voet and J.G.Voet, Biochemistry, John Wiley and Sons, 10990</li> <li>L.Stryer, Biochemistry W.H.Freeman and Company, 1965.</li> </ol>				n, Molecular netics, John 90
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant				

i	Title of the Course	Psychology / Sociology / Literature / Philosophy	Course HS 3xx Code
ii	Credit structure	L T P C 3 0 0 6	
iii	Prerequisite, if any(for the students)		
iv	Course Content	Will be provided by the cou	urse instructor
v	Texts/References	Will be provided by the	instructor
vi	Instructor(s)name		
vii	Name of other departments to whom the course is relevant		

i	Title of the Course	Mass Tran	sfer operations	Course Code	CL 301		
ii	Credit structure	LTP	С				
		2 1 0	6				
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content						
	Distillation: batch distillation, continuous fractionation, calculations with multiple feeds and withdrawals; Special dis- tillation techniques (azeotropic, extractive, etc.) steam and molecular distillation; Tray hydrodynamics and efficiencies; Liquid-Liquid extraction: Calculations with and without reflux for immiscible and partially miscible system; Gas absorp- tion: packed tower design, effect of reaction; Simultaneous heat and mass transfer: Drying; Design of cooling towers; Adsorption: Types and nature of adsorption; Freundlich isotherm; Membrane processes: Gas separation processes; reverse osmosis processes.						
v	Texts/References						
	<ol> <li>J.D. Seader and E.J. Henley, Separation Process Principles, 2nd ed., Wiley, 2005.</li> <li>E.L. Cussler, Diffusion: Mass Transfer in Fluid Systems, 2nd ed., Cambridge series, 1997</li> </ol>				d., Wiley, 2005. Cambridge		
	3. P.C. Wankat, Separation Process Engineering, 2nd ed., Prentice Hall, 2006.						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Chemical Engineering Lab II Course Code CL 311
ii	Credit structure	L T P C 0.5 0 2 3
iii	Prerequisite, if any(for the students)	Nil
iv	Course Content	(Focus: Heat and Mass Transfer) Experiments on hydrodynamics of a packed column, Differential distillation, Heat transfer in laminar and turbulent flow, boiling and condensation, Plate heat exchanger, Fluidization with heat transfer, heat transfer through a submerged helical coil, heat transfer in an agitated vessel, finned tube heat exchanger
v	Texts/References	
vi	Instructor(s)name	
vii	Name of other departments to whom the course is relevant	

i	Title of the Course	Basic Electric Circuits Lab. Course Co	de CL 313
ii	Credit structure	LTPC	L
		0 0 3 3	
iii	Prerequisite, if any(for the students)		
iv	Course Content	Will be provided by the lab instructor	
V	Texts/References	Will be provided by the lab instructor	
vi	Instructor(s)name		
vii	Name of other departments to whom the course is relevant		

i	Title of the Course	Che	emi	cal	Reaction	Engineering	Course Code	CL 302
ii	Credit structure	L	Т	Ρ	С			
		3	1	0	8			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Kinetics Reaction rate, order, rate constant; Batch reactors Design + basics; Kinetic constants from batch reactor data; Ideal flow reactors Mass and Energy balances; Isothermal, adiabatic and non-isothermal operation; Catalysts, Catalytic rates, Reaction mechanisms; Internal/External transport in catalysts; Non-catalytic solid-gas reactions; Reactor design for ideal flow reactors; Yield and Selectivity; Concept of RTD; Segregation and Maximum Mixedness model							
v	Texts/References							
	1. H.S.Fogler, Element New Jersey, 1992.	s of	Che	emic	al React	ion Engineerin	g, 2nd ed., Prenti	ce Hall,
	2. O.Levenspiel, Chem	nical	Rea	actic	on Engine	ering, 2nd ed.	, Wiley Eastern, <sup>-</sup>	1972.
	3. J.M.Smith, Chemica	al En	igine	eerii	ng Kineti	cs, 3rd ed., Mo	Graw Hill, 1980	
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Material Science	Course Code	CL 304	
ii	Credit structure	L T P C 3 0 0 6			
iii	Prerequisite, if any(for the students)	Nil			
iv	Course Content	Atomic Bonding, Crystal Structure and Defects, Mechanical and Thermal Behaviour: Failure Analysis and prevention, Phase Diagrams; Metals and alloys, Polymers (Plastics), Semiconductors, Ceramics & Glasses, Corrosion and its preven- tion, Environmental Effects, Nanotechnology, Biomaterials.			
v	Texts/References	1. J.F. Shackelford, Int for Engineers, 6th e	troduction to Ma ed., Prentice Ha	aterial Science I, 2004.	
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant				

i	Title of the Course	Chemical Engineering Lab III Course Code CL 312
ii	Credit structure	LTPC
		0 0 3 3
iii	Prerequisite, if any(for the students)	Nil
iv	Course Content	(Focus: Reaction Engineering and Unit Operations) Experiments on esterification kinetics, Batch reactive distillation, mi- cellar catalysis, homogeneous reaction, metal recovery from dilute solutions, reaction in CSTR, reaction in PFR, Gas chromatography, Cooling tower, gas liquid absorption
v	Texts/References	
vi	Instructor(s)name	
vii	Name of other departments to whom the course is relevant	

i	Title of the Course	Pro Eco	ocess	s Ec nics	uipment Design and	Course Code	CL 401
ii	Credit structure	L	Т	Ρ	С		1
		3	0	0	6		
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content						
	Mechanical design of process equipment: pressure vessels, tall columns, etc., process piping design; Materials and Fabri- cation Selection; Design Strategy and Optimum Equipment Design: Economic Design criteria; Cost and Asset Accounting; Cost Estimation; Interest and Investment Costs; Taxes and Insurance; Depreciation; Profitability, Alternative Investments and Replacement; Illustrative Case Study in Process Equipment Design and Costing of Equipment in each of the following categories: Material Transfer, Handling and Treatment Equipment Heat Transfer Equipment: Shell and tube heat exchangers (Kern and Bell-Delaware design methods), Plate heat exchangers, Evaporators Mass Transfer Equipment: Absorption/ Stripping columns (packed/tray), Multicomponent distallation colum (Fenske- Underwood-Gilliland correlations) Reactors: Choices of reactors, non-isothermal reactors, reactor configuration, interstage heating/cooling, multi-tubular reac- tors, catalyst deactivation.						
v	Texts/References						
	<ol> <li>M.S. Peters and K.D. Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill, 1991.</li> <li>D.F. Rudd and C.C. Watson, Strategy of Process Engineering, John Wiley, 1969.</li> <li>S. F.C. Jelen and J.H. Black, Cost and Optimization Engineering, McGraw Hill, 3rd ed., 1992.</li> <li>S. Walas, Chemical Process Equipment Selection and Design, Butterworth, 1988</li> <li>S. M.V. Joshi, Process Equipment Design, McMillan India, New Delhi, 1976.</li> <li>G. R.K. Sinnot, An Introduction to Chemical Engineering Design, Pergamor Press, Oxford, 1989.</li> <li>R. Smith, Chemical Process Design, McGraw Hill, 1995</li> </ol>				; for hn Wiley, /IcGraw elhi, Pergamon		
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Process Con	itrol	Course Code	CL 403
ii	Credit structure	L T P C 3 1 0 8			
iii	Prerequisite, if any(for the students)	Nil			
iv	Course Content First Principles model development; Process dynamics for first, second and higher order systems: linearisation, transfer function models, effect of poles, zeros and time delays on system response; Empirical models from data; control system instrumentation; introduction to feedback control: objectives, PID control; analysis of closed loop systems: stability, root locus, frequency response using Bode and Nyquist plots; control design techniques: design criteria, time and frequency domain techniques, model based design, tuning; advanced control strategies: cascade and feed forward, introduction to multivariable control; controller implementation through discretisation				
v	Texts/References				
	1. 1. D.E. Seborg Control, John V	, T.F. Edgar, D. Viley and Sons	. A. Mellicha s, 2nd ed., 20	amp, Process Dynan 004.	nics and
	2. 2. B.W. Beque Prentice Hall, N	tte, Process Co Jew Delhi, 200	ontrol: Mode 03.	eling, Design and Sir	mulation,
	3. 3. W.L. Luyber Engineers, 2nd	n. Process Moo ed., McGraw	deling Simu Hill, 1990.	lation and Control fo	or Chemical
	4. 4. G. Stephano Theory and Pra	poulos, Chem actice, Prentice	nical Process e Hall, New	Control: An Introdu Delhi, 1984.	uction to
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant				

i	Title of the Course	Chemical Engineering Lab - IV Course Code CL 411
ii	Credit structure	LTPC
		0 0 6 6
iii	Prerequisite, if any(for the students)	Nil
iv	Course Content	(Focus: Process Control, Unit Operations) Experiments on Residence time distribution, continuous distillation, Dynamic process modeling, identification of transfer functions, P /PI control, Temperature measurement and signal conversion, Con- trol valve characteristics, Fixed bed reactor, drying
v	Texts/References	
vi	Instructor(s)name	
vii	Name of other departments to whom the course is relevant	

i	Title of	the Course	Ch	emi	cal	Processes	Course Code	CL 402
ii	Credit	structure	L	Т	Ρ	С	L	
			3	0	0	6		
iii	Prereq the stu	uisite, if any(for dents)	Nil					
iv	Course	e Content	1					
	Introduction to fuels, Properties of fuels, Solid fuels and uses, liquid fuels and uses, Gaseous fuel and uses, Combustion and furnace calculations. Chemical processes based on agricultural and sylvicultural raw materials: Sugar, starch, alcohol, cel- lulose, paper, glyceride, oils, soaps, detergents; Petroleum refining Operations: Principles and details of Crude Distillation, Vacuum Distillation, coking, cracking, hydrotreating, isomerization and alkylation; Petrochemicals: Raw materials and principles involved in the production of olefins and aromatics. Acetylene, Butadiene and typical intermediates from olefins and aromatics such as ethylene glycol, ethyl benzene, phenol, curnene and DMT/PTA; dyes and pharmaceuticals, coal chemicals. Inorganic heavy chemicals: Processes for manufacture of acids, alkalis, salts and fertilizers. Typical products such as sulphuric, nitric, and phosphoric acids, soda ash, ammonia, superphosphates. Renewable resources, Biorefineries. Biopharmaceuticals. Fine chemicals and Biotransformations.							
v	Texts/F	References	.   .			M Diaman datad	Miles 0001	
	1.	J.A. Moulijn, M. Ma	акке	e ar	IC A	. V Diepen, 1st ed.,	vviley, 2001	
	2.	C.E. Dryden, Outline Rao and Marshall S	es o itting	of Cł g, 2'	nem <sup>nd</sup> e	ical Technology, Ed d., Affiliated East-V	lited and revised Vest Press, New	by M.Gopala Delhi, 1973
	3.	G.T. Austin, R.N. Sh 1984.	reve	e, Cł	nemi	cal Process Industr	ries, 5th ed., McC	Graw Hill,
	4.	P.H. Groggins , Unit	pro	cess	es i	n organic synthesis	, 5th ed., McGra	w Hill, 1958.
	5.	Kirk-Othmer D.F., E New York, 1991.	ncy	clop	edia	of Chemical Tech	nology, 4th ed. Ir	iterscience,
	6.	J.H. Gary and G.E. H Marcel Dekker, New	Hano 1 Yo	dwe rk, 2	rk, F 2001	Petroleum Refining	: Technology and	Economics,
	7.	S. Sarkar, Fuels and	Cor	nbu	stior	n, 2nd ed., Orient L	ongmans, Bomb	ay, 1990.
vi	Instruc	tor(s)name						
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Chemical Process Design	Course Code CL 404
ii	Credit structure	L T P C 3 0 0 6	
iii	Prerequisite, if any(for the students)	CL 354	
iv	Course Content Process Design and Develo Chemical Process Design; Th Reactor networks in process Separation systems in process ideal systems, distillation col Heat exchange networks sym Introduction to optimization design, Design under uncer	pment: General Design Cons ne Nature of Process Synthesis flowsheets: Attainable region ss flowsheets: multicomponent lumn sequences, heat integratic thesis and utilities: Energy targ approaches to optimal design rtainty and failure tolerance,	siderations; The Hierarchy of and Analysis; distillation for ideal and non- on in distillation columns gets , role of simulations in process Engineering around variations,
V	<ul> <li>Texts/References</li> <li>1. J. Douglas, Concep</li> <li>2. R. Smith, Chemical</li> <li>3. D.F. Rudd and C.C.</li> <li>4. R.K. Sinnot, An Introduction Oxford, 1989.</li> <li>5. L.T. Biegler, E.I. Grand Chemical Process I and Chemical Enge</li> <li>6. W.D. Seider and J. Synthesis, Analysis</li> </ul>	tual Design of Chemical Proce Process Design, McGraw Hill Watson, Strategy of Process E roduction to Chemical Engined ossmann, and A.W. Westerberg Design, Prentice Hall Internatio g. Sciences, 1997. D. Seader, Product and Process and Evaluation, 2nd ed., Joh	sses, McGraw Hill, 1989. I, New York, 1995. ngineering, John Wiley, 1969. ering Design, Pergamon Press, g, Systematic Methods of onal Inc. Series in the Physical as Design Principles: n Wiley, 2004
vi	Instructor(s)name		
vii	Name of other departments to whom the course is relevant		

i	Title of the Course	Design Lab. I	Course Code	CL 411
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Steady-state simulatio costing in flow sheets; Simulations using c HYSYS), Computationa	n of flow sheets; C Design and analysis of ommercial simulators al Fluid Dynamics, Mole	Optimization and control systems; (eg. ASPEN, cular modeling.
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Design Lab. II	Course Code	CL 413
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Process and Mechanica equipment; Numerical stu analysis of separation equ	al design calculatic udies in reactor des uipment.	ons for process ign; Design and
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

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Semester	I					
Course code	Course Name		Credit structure			
		L	Т	Р	С	
CH 101	Chemistry	2	1	0	6	
CS 101	Computer Programming & Utilization	2	0	2	6	
HS 101 HS 103	English Language Course * Introduction to Philosophy	3	0	0	6	
MA 101	Calculus	3	1	0	8	
PH 101	Electricity and Magnetism	2	1	0	6	
PH 111	Physics Lab.	0	0	3	3	
ME 101	Engineering Graphics & Drawing	0	1	3	5	
NC 101#	National Cadet Corps (NCC)	0	0	0	P/NP	
NO 101#	National Sports Organization (NSO)	0	0	0	P/NP	
NS 101#	National Service Scheme (NSS)	0	0	0	P/NP	
					40	

## Course Curriculum for B.Tech. Programme: Electrical Engineering Department

\* For students deficient in English Language

Semester	II				
Course Code	Course Name	Credit Structure			
		L	Т	Р	С
PH 102	Modern Physics	3	1	0	8
HS 102	Economics	3	0	0	6
CL 102 EE 102	Introduction to Chemical Engg ( <b>for CL</b> ) Intro. to Electrical and Electronic Circuits* ( <b>for EE and ME</b> )	3	0	0	6
MA 102 MA 104	Linear Algebra Ordinary Differential Equation - I	3 3	1 1	0 0	4 4
ME 102	Workshop Practice	0	1	3	5
CH 112	Chemistry Lab	0	0	3	3
NC 102#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 102#	National Sports Organization (NSO)	0	0	0	P/NP
NS 102#	National Service Scheme (NSS)	0	0	0	P/NP
					36

# Any one of these courses to be taken

Semester	III				
Course code	Course Name	Credit structure			
		L	Т	Р	С
MA 201	Complex Analysis	3	1	0	4
MA 203	Differential Equations-II	3	1	0	4
EE 201	Network Theory	2	1	0	6
EE 203	Electronics Devices	2	1	0	6
EE 205	Introduction to Electrical Systems	3	0	0	6
EE 211	Electronics Devices Lab	0	0	3	3
EE 213	Electrical and Electronics lab.	0	0.5	3	4
					33

Semester IV								
Course code	Course Name	Credit structure						
		L	Т	Р	С			
EE 202	Signals and Systems	2	1	0	6			
EE 204	Analog Circuits	2	1	0	6			
EE 206	Electrical Machines and Power Electronics	2	1	0	6			
EE 208	Digital Systems	2	1	0	6			
EE 212	Analog Lab.	0	0	3	3			
EE 214	Digital Circuits Lab.	0	0	3	3			
EE 216	Machine Lab.	0	0	4	4			
					34			
	HONOURS							
EE xxx	Honours Elective	3	0	0	6			

Semester	V				
Course code	Course Name	Credit structure			
		L	Т	Р	С
EE 301	Microprocessors	2	0	2	6
EE 303	Communication Systems	2	1	0	6
EE 305	EM Waves	2	1	0	6
EE 307	Probability and Random Processes	2	1	0	6
HS 3xx	HSS elective	3	0	0	6
					30
	HONOURS				
EE xxx	Honors Elective	3	0	0	6

Semester VI								
Course code	Course Name	Credit structure						
		L	Т	Р	С			
EE 302	Control Systems	2	1	0	6			
EE 304	Digital Signal Processing	2	1	0	6			
EE 306	Digital Communications	2	1	0	6			
EE 308	Power Systems	3	1	0	6			
EE 312	Communications Lab	0	0	3	3			
EE 314	Control Systems Lab	0	0	3	3			
					30			
	HONOURS							
EE xxx	Honors Elective	3	0	0	6			

Semester VII							
Course code	Course Name	Credit structure					
		L	Т	Р	С		
ES 202	Environmental Studies (half semester)	2	1	0	3		
HS 202	Environmental Studies (half semester)	2	1	0	3		
XX xxx	Institute Elective – I	2	1	0	6		
EE xxx	Department Elective – I	3	0	0	6		
EE xxx	Department Elective – II	3	0	0	6		
EE 451	B.Tech. Project – I	0	0	6	6		
					30		
	HONOURS						
EE xxx	Honors Elective	2	1	0	6		

Semester VIII								
Course code	Course Name	Credit structure						
		L	Т	Р	С			
XX xxx	Institute Elective – II	2	1	0	6			
EExxx / XX xxx	Department / Open Elective -III	3	0	0	6			
EExxx/X Xxxx	Department / Open Elective – IV	3	0	0	6			
EExxx	Department Elective – V &	3	0	0	6			
EExxx	Department Elective – VI or	3	0	0	6			
EE 452	B.Tech. Project – II	0	0	12	12			
					30			
	HONOURS							
EE xxx	Honors Elective	2	1	0	6			

## Elective List For B.Tech . Electrical Engineering

- 1. Discrete Data and Digital Control
- 2. Advanced Network Analysis
- 3. Information Theory and Coding
- 4. VLSI Technology
- 5. Electronic Design Laboratory (6 CREDITS, 0 0 6 6)
- 6. B. Tech Project II (12 CREDITS)
- 7. Error Correcting Codes
- 8. Fiber Optic Communication
- 9. Radiating Systems
- 10. Physics of Transistors
- 11. Optimal Control Systems
- 12. Simulation of Circuits and Devices
- 13. Finite Fields and their Applications
- 14. Electric Drives I
- 15. A First Course in Optimization
- 16. Application of Power Electronics to Power Systems
- 17. Physical Electronics
- 18. High Power Semiconductor Devices
- 19. Speech Processing
- 20. Introduction to MEMS
- 21. Circuit Simulation in Power Electronics
- 22. Behavioral Theory of Systems
- 23. Restructured Power Systems
- 24. Nanoelectronics
- 25. Computational Electromagnetics

i	Title of the Course	Cher	nistr	У		Course Code	CH 101
ii	Credit structure	L 1	T 1	P 0	C 6		
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content Schrodinger equation (origin of quantization), Born interpretation of wave function, Hydrogen atom: solution to Φ-part, MO theory: atomic and molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Examples N2, O2, CO and HF, Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes, Reactivity of carbonyl group (addition reactions, reactions due to acidic proton, addition-elimination reactions and reactivity of acid halide, ester and amide), Functional group interconversions involving oxidation and reduction, Periodic properties: trends in size, electron affinity, ionization potential and electronegativity, Use of Ellingham diagram and thermodynamics in the extraction of elements, Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion, Bioinorganic chemistry: storage and transport proteins, Catalysis: hydrogenation, hydroformylation and olefin metathesis						
V	Texts/References P.W.Atkins, Physical Che G.M.Barrow, Physical Che D.A.McQuarrie and J.D. S Books Pvt. Ltd. (1998). R. Hall of India Pvt. Ltd., 5t Education 6th Ed, 2006. Wiley & Sons (Asia) Pte L Applications, McGraw Hi Edition, ELBS, 1991. D 1984.	emistry imon, T.Mor h Ed, G. Sc td. M. II, 198 D.D.Et	y, C y, 5tl risoi 199 Joom J.Si 80.	Dxfo h Ec ysica ons ons enko J.E g, G	rd University Pre lition, Tata McGra al Chemistry - a m d R.N. Boyd, Org G. Wade, Orga and C. Fryhle, C o and R.A.Plane, D.Lee, Concise In General Chemistry	ess, 7th E w-Hill, New nolecular a anic Chemi Drganic Ch Chemical I norganic C y, Houghtc	Edition, 2006. v Delhi, 1992. pproach, Viva istry, Prentice istry, Pearson emistry, John Principles and Chemistry, 4th on Miffin Co.,
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant	All de	epar	tme	nts		

i	Title of the Course	Comp Utiliza	ute tior	r Programming and 1	Course code	CS 101
ii	Credit structure	LΤ	Ρ	С		
		2 0	2	6		
iii	Prerequisite, if any(for the students)	High School Mathematics				
iv	Course Content					
	<u>Description:</u> This course provides provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include:					
	<ul> <li>A. Utilization: Develope environment, Unix sl</li> <li>B. Programming feature records, objects, ex functions, and basic</li> <li>C. Sample problems in methods.</li> </ul>	er fundamentals such as editor, integratedprogramming shell, modules,libraries. res: Machine representation, primitive types, arrays and expressions, control statements, iteration, procedures, c i/o. n engineering, science, text processing, and numerical				
	Texts/References					
	1. G. Dromey, He Saddle River,	ow to S NJ, 19	Solv 982	e It by Computer, Prent	ice-Hall, In	ic., Upper
	<ol> <li>Polya, G., Hov</li> <li>C++ Program Oriented Desi edition. 2003.</li> <li>Let`s C. Yash</li> <li>The Java Tuto</li> </ol>	w to Solve It (2nd ed.), Doubleday and co. (1957). Design: An introduction to Programming and Object- sign. Tata McGraw Hill. Coohoon and Davidson. 3 <sup>rd</sup> . Nwant Kanetkar. Allied Publishers, 1998. torial, Sun Microsystems. Addison-Wesley, 1999.				
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant	All Department				

i	Title of the Course	Economics	Course Code	HS 102		
ii	Credit structure	LTPC				
		3 0 0 6				
iii	Prerequisite, if any(for the students)	None				
iv	Course Content					
	Basic economic problems. Resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balace payments, stabilization policies : Monetary, Fiscal and Exchange rate policies.					
v	Texts/References					
	P. A. Samuelson &	W. D. nordhaus, Econo	omics, McGr	aw Hill, NY, 1995.		
	<ul> <li>A. Koutsoyiannis, and D. L. Rubinf NY, 1989.</li> </ul>	, Modern Microeconomics, Macmillan, 1975. R. Pindyck Ifeld, Microeconomics, Macmillan publishing company,				
	R. J. Gordon, Mac 1987. William F. S	croeconomics 4th edition Shughart II,	n, Little Brow	n and Co., Boston,		
	The Organization	of Industry, Richard D. Ir	rwin, Illinois,	1990.		
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant	All Departments				

i	Title of the Course	Ca	lculu	IS			Course code	MA 101
ii	Credit structure	L	Т	Ρ	С			
		3	1	0	8			
iii	Prerequisite, if any(for the students)	No	ne					
iv	Course Content							
	Review of Limits, continuit	ty, d	liffer	entia	ability.			
	Mean value theorem, Tayl	ors	The	oren	n, Maxima	and Min	ima.	
	Riemann integrals, Fund applications to area, volum	damental theorem of Calculus, Improper integrals, ne						
	Convergence of sequence	es a	nd s	erie	s, power s	eries.		
	Partial Derivatives, gradie minima, Lagrange multipli	ent a ers.	and	dire	ctional dire	evatives,	chain rule, ma	xima and
	Double and Triple integrat	ion,	Jac	obia	ns and ch	ange of v	variables formu	la.
	Parametrization of curves	and	d sur	face	es, vector l	Fields, Li	ne and surface	integrals.
	Divergence and curl, Theo	orer	ns o	f Gre	een, Gaus	s, and St	okes.	
V	Texts/References							
	1. Hughes-Halle	tt e	et a	l, C	Calculus -	- Single	and Multivar	<i>iable</i> (3 <sup>rd</sup>
	2. James Stewar	rt, C	Calci	ulus	(5 <sup>th</sup> Editior	<i>ז)</i> ו), Thoms	son (2003)	
	3. T.M. Apostol,	Cal	lculu	<i>s</i> , V	olumes 1 a	and 2 (2 <sup>n</sup>	<sup>d</sup> Edition), Wile	y Eastern
	4. G.B.Thomas	and	R.L	Fin	ney, <i>Calc</i>	ulus and	l Analytic Geo	metry (9 <sup>th</sup>
	Edition), ISE F	Rep	rint,	Add	ison-Wesl	ey, 1998.		
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	All	Dep	artm	ients			

i	Title of the Course	Ele	ectric	city a	and	Magnetism	Course code	PH 101
ii	Credit structure	L 2	T 1	P 0	C 6			
iii	Prerequisite, if any(for the students)	No	one					
iv	Course Content							
	<ul> <li>Electrostatics: Coulomb's law, Gauss theorem, electric potential, Laplace's equation, Poisson's equation, electrostatics with conductors, capacitors, dielectrics. Magnetostatics: Biot Savart's law, Ampere's law, Lorentz force.</li> <li>Magnetic Induction: Faraday's law, Lenz's law, self and mutual inductance, energy in a magnetic field, LCR circuit, resonance. Maxwell's equations: displacement current, electromagnetic waves, plane wave solutions of Maxwell's equations, Poynting vector, wave propagation through a boundary, reflection, refraction, absorption and skin depth.</li> </ul>							
v	Texts/References							
	A.S. Mahajan and A. Rar 1989. D. Griffiths, Introduction to	ngav o Ele	wala ectro	ı, El odyn	ectr ami	icity and M ics, 2nd ed.	agnetism, Tata , Prentice Hall,	McGraw Hill, 1989.
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	All	dep	artn	nent	S		

i	Title of the Course	Chemistry Lab	Course code	CH 112
ii	Credit structure	LTPC		
		0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	Experiments illustrating the cells, (2) thermochemistry, equilibrium constant, (5) reduction titration.	e concepts of (3) chemical l analysis by	1) galvanic kinetics, (4) oxidation
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant	All departments		

i	Title of the Course	Engineering Graphics and Course code ME 101 Drawing
ii	Credit structure	L T P C 0 1 3 5
iii	Prerequisite, if any(for the students)	None
iv	Course Content	Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections. v
V	Texts/References	Bhatt N. D. and Panchal V. M., Engineering Drawing, Charotar Publishers, Anand, 2007. Luzadder Warren J. and Duff Jon M., Fundamentals of Engineering Drawing, Prentice Hall of India, 2001. French Thomas E. and Vierck Charles J., Engineering Drawing and Graphic Technology, McGraw Hill, 1993. Jolhe Dhananjay A., Engineering Drawing, Tata McGraw Hill, 2007. Shah M. B. and Rana B. C., Engineering Drawing, Dorling Kindersley (India) Pvt. Ltd, Pearson Education,
vi	Instructor(s)name	
vii	Name of other departments to whom the course is relevant	

i	Title of the Course	Modern Physics	Course Code	PH 102	
ii	Credit structure	L T P C 3 1 0 8	<u>.</u>		
iii	Prerequisite, if any(for the students)	None			
iv	<ul> <li>Course Content</li> <li>Special theory of relativity: Galilean and Lorentz transformation, space time viewpoints, Minkowski space and four vectors, energy momentum conservation.</li> <li>Review of quantum concepts, Black body radiation, particle nature of light, photoelectric effect, Compton effect, matter waves, wave packets, phase and group velocity, Davisson Germer experiment, Franck-Hertz experiment, Heisenberg uncertainty principle.</li> <li>Schrödinger equation, probabilistic interpretation of wave function.</li> <li>One dimensional problems-particle in a box, potential well, potential barrier and tunneling, harmonic oscillator.</li> <li>Hydrogen atom.</li> <li>Elements of statistical Physics: Maxwellian distribution, Bose-Einstein and Fermi-Dirac distributions.</li> </ul>				
v	Texts/References 1. H.S. Mani and 2. S.H. Patil, Ele 3. K.S. Kane, Mo 4. Beiser, Conce	d G.K. Mehta, Introduction to Modernents of Modern Physics. Odern Physics opts of Modern Physics	ern Physics		
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant	All Departments			

i	Title of the Course	Introd	uctio	on to Philosophy	Course Code	HS 103
ii	Credit structure	L T 3 0	P 0	C 6		
iii	Prerequisite, if any(for the students)	None				
iv	Course Content					
	The course will acquaint issues on the nature ar ethical issues arising ou objective is to develop issues relating to the foll Growth of scientific kno science. Conceptual evo science: induction, falsif scientific laws and theori Relationship between s Nature of scientific expla model. Selected case s mathematical reasoning: axioms: formal axiomatic completeness. Nature of axiomatic systems and pr understanding of mind an and cognitivist. Ethics: elements of environmenta	urse will acquaint the students of science and engineering with some on the nature and methods of science and mathematics, and the issues arising out of the application of science and technology. The e is to develop a critical, reflective and historical awareness on the relating to the following topics: Philosophy and History of Science: of scientific knowledge: factors leading to the emergence of modern . Conceptual evolution: internal and external history. Methodology of : induction, falsificationism, confirmation and probability. Nature of c laws and theories: realism, instrumentalism and underdetermination. Iship between scientific observation, experiment and scientific theory. of scientific explanation: teleological explanations and the covering law Selected case studies on scientific theories.Logic and the nature of formal axiomatic systems. Concept of consistency, independence and eness. Nature of rules of inference and proof. Selected examples of ic systems and proof procedures. Cognition: Current approaches to the anding of mind and mental processes: empiricist, rationalist, behaviourist pritivist. Ethics: Impact of science and technology on man and society: is of environmental and professional ethics.				
V	Texts/References					
	A.C. Grayling (Ed.) Pl University Press, Londow Scientific Thought: An I London 1968.I.B. Cohen, Eves and C.V. Newson Mathematics, Boston, P' Sayre (Eds.) Ethics and I London, 1979.S.D. Agas Science, Technology and 1980.	nilosoph n, 1995 ntroduc The B n, Four WS-Kai Problem he, A.C Societ	ny; Ma ition irth o ndati t P ndati t P ndati y: A	A Guide through the first W. Wartofsky, Con- to the Philosophy of a New Physics, Pe- ons and Fundamen ub. Co., 1990.K.E. f 21st Century, Univ a and K. Valicha (Ed Book of Readings, U	he subject, ceptual Found of Science, N onguin Books tal Concep Goodpaster of Notre Dar ds.) Scientific Jniv. of Bomb	Oxford dations of Aacmillan, s, 1985.H. ts of and K.M. me Press, c Method, bay Press
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant	All Dep	oartn	nents		

i	Title of the Course	Inti Ele	rodu ectro	uctic onic	on to Electrical and Circuits	Course code	EE 102
ii	Credit structure	L	Т	Ρ	С		
		3	0	0	6		
iii	Prerequisite, if any(for the students)	No	ne				
iv	Course Content						
	Introduction, basic phys	sica	l la	ıws,	circuit elements, KV	L, KCL, a	nd a few
	important circuit theorem	is, simple circuits,					
	Transients in R-L, R-C, I	R-L-C, Sinusoidal Steady State, Real/Reactive Power,					
	Three Phase Working F	Principles of Transformers/AC/DC machines Functional					
	Characteristics of Diode	ə, E	ЗJT,	0	P-AMP Analog circuit	Examples:	rectifiers,
	amplifiers, oscillators etc	. D	igita	l C	ircuits: AND/OR gates,	Flip Flops,	DAC/ADC
	etc.						
		1					
V	Texts/References	1	. Vir F	ncei und	nt Del Toro, `Electrical E amental, Prentice Hall,	ngineering 1989	
		2	. K./ ai E	A.Ki nd E aste	rishnamurthy and M.R.F Electronics Engineering ern Ltd., 1993.	aghuveer, for Scientis	`Electrical ts', Wiley
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Linea	r Alg	ebra		Course Code	MA 102
ii	Credit structure	L T 3 1	P 0	C 4			
iii	Prerequisite, if any(for the students)	None					
iv	Course Content						
	Vectors in $R^n$ , notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of $R^n$ , basis of a vector subspace.						
	<ul> <li>Systems of Linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix.</li> <li>Determinants and rank of a matrix in terms of determinants.</li> <li>Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem.</li> <li>Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation.</li> <li>Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, applications to quadratic forms.</li> </ul>						
v	Texts/References						
	H.Anton, <i>Elemen</i> Wilov (1995)	tary li	near	algebra witl	h app	olications	(8 <sup>th</sup> ed.), John
	<ul> <li>G.Strang, <i>Linear a</i></li> <li>S.Kumaresan, <i>Lir</i></li> </ul>	ilgebra iear ai	a anc Igebr	l its applicatio a – A Geome	ons (4i etric a	rh Ed.), Th <i>pproach</i> , I	nomson (2006) Prentice Hall of
	<ul> <li>E.Kreyszig, Adva (1999)</li> </ul>	anced Engineering Mathematics (8 <sup>th</sup> Ed.), John Wiley					
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Ordinary Differential Equations - I Course MA 104 code				
ii	Credit structure	L T P C 3 1 0 4				
iii	Prerequisite, if any(for the students)	None				
iv	Course Content Exact equations, i Orghogonal trajec Lipschitz condition Linear differential Linear dependenc Diamensionality o Linear ODE's with Cauchy-Euler equ Method of undete Method of variatic Laplace transform Shifting theorems Convolution theor	integrating factors and Bernoulli equations. ectories. on, Picard's theorem, examples on nonuniqueness. I equations generalities. ice and Wornskians. of space of solutions, abel-Liouville formula. th constant coefficients, the characteristic equations. juations. ermined coefficients ion of parameters. m generalities.				
V	<ol> <li>Texts/References</li> <li>E.Kreyszig, Advanced engineering mathematics (8<sup>th</sup> Ed.), John Wiley (1999)</li> <li>W.E.Boyce and R. DiPrima, Elementary Differential Equations (8<sup>th</sup> Ed.) John Wiley (2005)</li> <li>T.M.Apostol, Calculus, Volume 2 (2<sup>nd</sup> Ed.), Wiley Eastern, 1980.</li> </ol>					
vi	Instructor(s)name					
vii	ii Name of other departments to whom the course is relevant					

i	Title of the Course	Wc	orks	hop	Practice	Course Code	ME 102	
ii	Credit structure	L O	T 1	P 3	C 5	<u>.</u>	·	
		Ŭ	•	0	<u> </u>			
iii	Prerequisite, if any(for the students)	No	ne					
iv	Course Content							
	Introduction to wood work: hand tools & various operations. Introduction to pattern making: types of patterns, allowances, colour coding. etc. Introduction to bench work & fitting: tools & operations. Introduction to metal cutting and machine tools: Safety measures, principles of operation of basic machine tools like lathe, shaping, & drilling. Important operations on these machines. Cutting tools and their usage, selection of cutting speeds, feeds, etc. Introduction to welding. Assignments: Simple assignments in wood working, fitting, electric arc welding, lathe and shaping machine work.							
v	Texts/References							
	<ol> <li>Elements of Worksho Hajrachoudhury &amp; Oth Mumbai. 14th Edition</li> <li>Elements of Worksho Hajrachoudhury &amp; Oth Mumbai. 12th Edition,</li> <li>Workshop Practice by</li> </ol>	<ul> <li>Elements of Workshop Technology, Vol. I by S. K.</li> <li>Hajrachoudhury &amp; Others, Media Promoters and Publishers,</li> <li>Mumbai. 14th Edition, 2007.</li> <li>Elements of Workshop Technology, Vol. II by S. K.</li> <li>Hajrachoudhury &amp; Others, Media Promoters and Publishers,</li> <li>Mumbai. 12th Edition, 2007.</li> <li>Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.</li> </ul>						
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	All	Dep	oarti	ments			

i	Title of the Course	Physics Lab.			ab.	Course code	PH 111		
ii	Credit structure	L	Т	Ρ	С				
		0	0	3	3				
iii	Prerequisite, if any(for the students)								
iv	<ul> <li>iv Course Content</li> <li>Error analysis and accuracy of measurement.</li> <li>Selected experiments from the following: current and voltage sensitivities o moving coil galvanometer, measurement of self inductance using Anderso bridge, resistivity of a thermistor, Helmholtz coil. Fresnel biprism, Newton's rin Young's modulus using Koenig's method, physical pendulum, Kundt's Tul Laser Diffraction, Grating Spectrometer, G.M. Counter.</li> </ul>								
v	Texts/References 1. B.L. Worsnop and H.T. Flint, Advanced Practical Physics for students, As								
	Publishing House, 1971.								
	2. G.L. Squires, University Press, Cambridge, 1999.								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Comp	lex A	Analysis	Course Code	MA 201		
ii	Credit structure	L T P C 3 1 0 4						
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content Definition and Cauchy-Riem Power series Elementary fu Cauchy's theo Taylor series Evaluation of Conformal ma Inversion of L	d properties of analytic functions. nann equations, harmonic functions. and their properties. unctions orem and its applications. and Laurent expansions. improper integrals. appings. aplace transforms.						
V	Texts/References 1. R.V.Churchill (7 <sup>th</sup> Edition), N 2. J.M.Howie, C 3. M.J.Ablowitz Applications, 4. E.Kreyszig, A Wiley (1999)	<ol> <li>R.V.Churchill and J.W.Brown, Complex variables and applications (7<sup>th</sup> Edition), McGraw-Hill (2003)</li> <li>J.M.Howie, Complex analysis, Springer-Verlag (2004)</li> <li>M.J.Ablowitz and A.S.Fokas, Complex Variables – Introduction and Applications, Cambridge University Press, 1998 (Indian Edition)</li> <li>E.Kreyszig, Advanced engineering mathematics (8<sup>th</sup> Edition), John Wiley (1999)</li> </ol>						
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							
i	Title of the Course	Differe	ntia	I Equations – II	Course Code	MA 203		
-----	---	---	---	---	---	---------		
ii	Credit structure	L T 3 1	P 0	C 4				
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content 1. Review of pov 2. Legendre's ed 3. Regular and i 4. Bessel's equa 5. Strum-Liouvill 6. Fourier series 7. D'Alembert so 8. Classification 9. Laplace, Wav 10. Vibration of a 11. Heat equation	ver seri quation rregular ition an e proble olution t of linea e and F circular i in the	ies and r sir d B ems o th ar se Heat r me half	and series solution d Legendre polync agular points, meth essel's functions we Wave equation econd order PDE t equations using embrane space.	ns of ODE's. omials. hod of Frobenius in two variables. separetion of var	iables.		
V	<ol> <li>Texts/References</li> <li>E.Kreyszig, Advanced engineering mathematics (8<sup>th</sup> Edition), John Wiley (1999)</li> <li>W.E.Boyce and R.DiPrima, Elementary Differencial Equations (8<sup>th</sup> Edition), John Wiley (2005)</li> <li>R.V.Churchill and J.W.Brown, Furier series and boundary value problem (7<sup>th</sup> Edition) MoGraw Hill (2006)</li> </ol>							
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Network Th	heory	Course Code	EE 201				
ii	Credit structure	L T P	C 6		<u></u>				
			<b>.</b>						
iii	Prerequisite, if any(for the students)	Nil							
iv	Course Content								
	Graphs of networks; current and voltage spaces of graphs and their representations: incidence, cutset and circuit matrices; Tellegen's Theorem.								
	Formal study of methods of analysis such as nodal, modified nodal, cutset, loop analysis for linear networks. Multiport representation for networks with particular emphasis on 2-ports.								
	Time domain analysis of space methods.	R, L, M, C	C, controlled	sources, netwo	orks using state				
	Introduction to s-domain n	nethods.							
v	Texts/References								
	<ol> <li>N Balabanian and Properties, Design</li> </ol>	l T.A. Bickar n and Synth	rt, Linear Ne iesis, Matrix	twork Theory: Ar Publishers, Inc.	nalysis, 1981.				
	2. L.O. Chua, C.A. McGraw - Hill Inte	Desoer, E.S ernational Ec	S. Kuh, Line dition 1987.	ar and Nonlinea	r Circuits,				
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Electronic Devices	Course Code EE 203			
ii	Credit structure	L T P C 2 1 0 6				
iii	Prerequisite, if any(for the students)	Nil				
iv	Course Content Modeling devices: Static characteristics of ideal two terminal and three terminal devices; Small signal models of non-linear devices. Introduction to semiconductor equations and carrier statistics: poisson's and continuity equations, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics. Semiconductor Diodes: Barrier formation in metal-semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. Field Effect Devices : JFET/HFET, MIS structures and MOSFET operation JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models. Bipolar transistors : IV characteristics and elers-Moll model; small signal models; Charge storage and transient response. Discrete transistor amplifiers: Common emitter and common source amplifiers Emitter and source followers.					
v vi vi	<ol> <li>Texts/References</li> <li>D. A. Neamen, Se Mirror High Educa</li> <li>E.S. Yang, Microe</li> <li>B.G. Streetman, S New Delhi, 1995.</li> <li>J. Millman and A. 1987.</li> <li>A.S. Sedra and F College Publishing</li> <li>R.T. Howe and C Prentice Hall Inter</li> <li>Instructor(s)name</li> </ol>	emiconductor Physics and De ation Group, Chicago) 1997. electronic Devices, McGraw I solid State Electronic Devices Grabel, Microelectronics, M K.C. Smith, Microelectronic g, 1991. .G. Sodini, Microelectronics: mational, 1997.	evices (IRWIN), Times Hill, Singapore, 1988. s, Prentice Hall of India, IcGraw Hill, International, Circuits, Saunder's : An integrated Approach,			
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Int Sy	rodu sterr	ction 1s	to Electrical		Course Code	EE 205
ii	Credit structure	L	Т	Ρ	С			
		3	0	0	6			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Passive elements, Sources, Review of Kirchhoff's Laws: KCL, KVL, ; Mesh and Nodal analysis; Steady state ac circuit analysis, phasors; Single phase, Power, Reactive power, Power factor improvement, 3 phase circuits; Magnetic circuits and Mutual inductance ; Transformers, DC machines, Induction machines (1 and 3 phase), Synchronous machines, Stepper motor; Introduction to Power Engineering						, ; Mesh and hase, Power, netic circuits achines (1 on to Power	
v	Texts/References							
	1. Vincent Del Toro, `El	lect	rical	Engi	neering Funda	amen	tal, Prentice	e Hall, 1989
	2. P.C.Sen, `Principles Wiley and Sons 198	of I 9	Elect	trical	Machines and	Pow	er Electron	ics', John
	3. I.J.Nagrath, `Basic E	Elec	trica	l Eng	ineering', Tata	McG	àraw Hill, In	dia. 1988
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Electronics Devices Lab.	Course Code	EE 211
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	Nil		
iv	Course Content	(To supplement <b>EE112</b> Course)	and Electro	onic <b>Devices</b>
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Basic Electric Laboratory	Course Code	EE 213
ii	Credit structure	L T P C 0 0.5 3 4		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by the lab	instructor	
v	Texts/References	Will be provided by the lab	instructor	
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Signals and Systems	Course Code	EE 202		
ii	Credit structure	L T P C 2 1 0 6				
iii	Prerequisite, if any(for the students)	Nil				
iv	Course Content					
	<ul> <li>Continuous-time signals and systems: signal characteristics; common signals; properties of continuous-time systems.</li> <li>Continuous linear time-invariant systems: impulse response; convolution; linear constant-coefficient differential equations.</li> <li>Fourier series, Fourier transform Laplace transform: system analysis; frequency response; analog filters.</li> <li>State-space analysis for continuous-time systems Discrete-time signals and systems</li> <li>Discrete-time LTI systems: convolution; difference equations.</li> </ul>					
V	Texts/References 1. R.F. Ziemer, - Continuous 2. A.V. Oppenhor Prentice Hall, 3. B.P. Lathi, Sig Press, 1998.	W.H. Tranter and D.R. Fa and Discrete, 4th Edn. Prer eim, A.S. Willsky and I.T. Y 1983. gnal Processing and Linear	annin, Signals ntice Hall, 199 ′oung, Signals Systems, Oxf	and Systems 8. and Systems, ord University		
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Ana	alog	g Ci	Course Code EE 204		
ii	Credit structure	L 2	T 1	P 0	C 6		
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content Introduction to operatio operational amplifier m Analysis of simple opera Frequency response of Feedback: Feedback to stability of feedback circ Linear applications amplifiers; Current and v Non-linear application and clampers; Lineariza multifunction circuits and Waveform Generation: square-triangle oscillato Real operational amp	urse Content oduction to operational amplifiers: The difference amplifier and the ideal erational amplifier models, concept of negative feedback and virtual short; alysis of simple operational amplifier circuits; equency response of amplifiers, Bode plots. edback: Feedback topologies and analysis for discrete transistor amplifiers; bility of feedback circuits using Barkhausen criteria. ear applications of operational amplifiers: Instrumentation and Isolation plifiers; Current and voltage sources; Active filters. n-linear applications of operational amplifiers: Comparators, clippers d clampers; Linearization amplifiers; Precision rectifiers; Logarithmic amplifiers, nultifunction circuits and true rms converters. aveform Generation: sinusoidal feedback oscillators; Relaxation oscillators, uare-triangle oscillators al operational amplifiers: Current sources and active loads, difference,					
	amplifier parameters on Analog and Digital int multiplexers.	onal circi erfac	ar uit   ce	npli perf circ	fier param formance. cuits: A/D, [	officiency capacitors eters; Effects of D/A Converters, S	in frequency real operational
v	<ul> <li>Texts/References</li> <li>1. J.V. Wait, L.P. Hue theory and applica</li> <li>2. J. Millman and A. O</li> <li>P. Horowitz and W. H</li> <li>3. Cambridge University</li> <li>4. A.S. Sedra and K.O Publishing, Edition</li> <li>5. Paul R.Gray \&amp; Ro Circuits, Wiley, 3 ro</li> </ul>	elsm tions Grab lill, T sity I C. S I IV bert d Ed	ian s, 2 pel, The Pre Smi Gl	anc Ind Mic Art ess, th, Mey n	d GA Korn, In edition, McG croelectronics of Electronic 1989. Microelectro ver, Analysis	troduction to Opera raw Hill, New York, s, 2nd edition, McG s, 2nd edition, onic Circuits, Saur and Design of Anal	ational Amplifier 1992. Iraw Hill, 1988. Inder's College log Integrated
vi	Instructor(s)name						
VII	departments to whom the course is relevant						

i	Title of the Course	Electrical Machines and Power Electronics				Course Code	EE 206	
ii	Credit structure	L	Т	Ρ	С			
		2	1	0	6			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Review of principles of operation of dc, induction and synchronous machines							
	Operating Characteristics of dc and ac machines, Speed control of dc and induction motors.							
	Operating characteristics of power semi-conductor devices, principle of operation of single and three phase ac-dc line commutated converters, introduction to unity power factor converters.						operation on to unity	
	Principle of operation dc-o converters.	dc (	buc	k, b	oost, buck-boost, cuk,	fly-back and	forward)	
	Principle of operation sir techniques.	ngle	ph	ase	and three phase dc	-ac converte	ers, PWM	
v	Texts/References							
	1. P.C. Sen, "Princip Second Edition, J	les ohn	of E Wi	lec ley	tric Machines and Pow & Sons-1996	er Electronic	s,"	
	2. M.H. Rashid, "Pov Third Edition, Pre	wer ntice	Ele e-Ha	ctro all c	nics Circuits, Devices a of India Private Limited,	and Applicati New Delhi-2	ons," 2004.	
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Digita	l Sy	stems	Course Code	EE 208
ii	Credit structure	L T 2 1	P 0	C 6		
iii	Prerequisite, if any(for the students)	none				
iv	Course Content Review of basic electronics, Digital Logic Family Number systems Finite State Machily Introduction to Ha Array based logic Special Topics ( special digital system)	combi ilies: T and ba ine De rdware eleme such tems, a	natio TL, o sign e De nts o as o asyr	onal and seque CMOS etc., digital arithmetic , Analysis and S scription Langua (Memory, PLA, F processor desig	ntial logic, Revi , ynthesis, age, FPGA), gn, testing and machines etc.)	ew of digital verification,
V	<ol> <li>Texts/References</li> <li>J.F.Wakerly: Digita Pearson Education</li> <li>Charles H Roth: D 1998</li> <li>Taub and D. Schill</li> <li>D.A. Hodges and I Circuits, Internatio</li> <li>F.J. Hill and G.L. F Wiley, 1981.</li> <li>Kohavi, Switching</li> </ol>	Il Desig n, 2009 igital S ing, Di H.G. Ja nal Stu Peterso and Fi	gn, F 5 Syste gital acks iden on, S nite	Principles and Prems Design usin Integrated Electon, Analysis and Edition, McGrowitching Theory Automata Theory	ractices, 4th Edit g VHDL, Thoms tronics, McGraw I Design of Digita raw Hill, 1983. v and Logic Desi ry, McGraw Hill,	tion, on Learning, <sup>7</sup> Hill, 1977. al Integrated gn, John 1970.
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Analog Lab.	Course Code	EE 212
ii	Credit structure	LTPC		
		0 0 3 3		
iii	Prerequisite, if any(for the students)			
iv	Course Content	(To supplement Analog	g Circuits Course	e)
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Digita	l Cir	cuits Lab.	Course Code	EE 214
ii	Credit structure	LΤ	Ρ	С		
		0 0	3	3		
iii	Prerequisite, if any(for the students)					
iv	Course Content	(To s <b>Digita</b>	upp I <b>I Sy</b>	lement Introduc /stems Course)	tion to Elect	r <b>onics</b> and
v	Texts/References					
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Machines	Laboratory	Course Code	EE 216
ii	Credit structure	L T P 0 0 4	C 4		
iii	Prerequisite, if any(for the students)				
iv	Course Content	(To supple and <b>Elect</b> i Courses)	ment Introduction t rical Machines and	o Electrical S Power Electro	ystems onics
v	Texts/References				
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant				

i	Title of the Course	Microprocessors	Course Code	EE 301				
ii	Credit structure	LTPC						
		2 0 2 6						
iii	Prerequisite, if any(for the students)	Digital Systems Course						
iv	Course Content Theory: A block diagram view of and software architectur registers and memory org	a general purpose process res; introductory data an	sor; elements o id control path	f hardware s concepts,				
	Instruction set basics and assembly language programming: Instruction structure and addressing modes, instruction encoding, detailed study of 8085A instruction set and interfacing basics: memory interfacing, principles of I/O interfacing, polled and interrupts I/O handshaking principles. Examples of I/O devices: parallel port, serial port, keypad, display, etc.							
	Introductory micro controll	lers.						
	Laboratory: Supplements the theory 8085-microprocessor kit based experiments: Software experiments demonstrate the use of the instruction set and assembly language programming. Hardware experiments for memory interfacing, parallel port, serial ports, interrupt driven I/O Simple micro controllers based experiments.							
v	Texts/References							
	<ol> <li>R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996</li> <li>D. A .Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.</li> <li>Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.</li> <li>Kenneth J. Ayala, the 8051 Microcontroller, Penram International Publishing, 1996.</li> </ol>							
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Communication Systems	Course Code	EE 303				
ii	Credit structure	L T P C 2 1 0 6						
iii	Prerequisite, if any(for the students)	Signals and Systems Co	ourse					
iv	Course Content							
	Review of signals and systems, Frequency domain of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation., Representation of FM and PM signals. Spectral characteristics of angle modulated signals.							
	Review of probability and random process. Gaussian and white noise characteristics. Noise in amplitude modulation systems. Noise in Frequency modulation systems. Preemphasis and Deemphasis. Threshold effect in angle modulation.							
	Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM). Differential pulse code modulation. Delta modulation. Noise considerations in PCM. Time Division multiplrxing. Digital Multiplexers.							
v	Texts/References							
	<ul> <li>Haykin S., "Communications Systems", John Wiley and Sons, 2001.</li> <li>Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.</li> <li>Taub H. and Schilling D.L., "Prnciples of Communication Systems", Tata McGraw Hill, 2001.</li> </ul>							
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	ΕM	Wa	ave	S	Course Code	EE 305
ii	Credit structure	L 7	Г	Ρ	С		
		2 -	1	0	6		
iii	Prerequisite, if any(for the students)						
iv	Course Content Review of Maxwell's e isotropic medium, polariz incident on a boundary - skin depth, weakly disper Field analysis of guide impedance, voltage and o standing waves, imped transmission lines, lossy li Field analysis of guide waveguides), quantization frequencies, dispersion n modes, excitation of wav coaxial cables. Electromagnetic radiatio potentials (Lienard-Wiech Hertzian dipole, formulati antenna gain, radiation	equations, TEM modes in a linear homogenous ization, Pointing vector and power flow, TEM waves - Snell's laws, wave propagation inside a conductor - ersive TEM modes - phase and group velocity. ded TEM modes (transmission lines), characteristic current relationships, impedance discontinuities and edance matching, Smith chart, pulse propagation in lines. uided non-TEM modes (rectangular and cylindrical on of modes by boundary conditions, mode cut-off relation, field patterns, power flow, orthogonality of aveguide modes by coaxial cables, non-TEM modes in ion - inhomogeneous wave equation, solution by chert formula), retarded potentials, radiation from a ation of the antenna problem as an integral equation, n resistance radiation pattern					
	optical.	stan	dar	da	ntennas -	dipole, array, ape	rture, horn, and
v	<ol> <li>Texts/References</li> <li>Ramo, S., Whinnery J.R., and van Duzer, T: Fields and Waves in Communication Electronics, 3rd ed., Wiley Eastern (1997).</li> <li>R.E. Collin, Foundations for Microwave Engineering, 2nd ed., McGraw-Hill, 1993.</li> <li>Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.</li> </ol>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Probability and Random Processes	Course Code	EE 307		
ii	Credit structure	L T P C 2 1 0 6				
iii	Prerequisite, if any(for the students)					
iv	Course Content Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models; Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions; Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds; Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem. Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.					
V	<ul> <li>Texts/References</li> <li>1. Stark and J. Woods, ``Probability and Random Processes of Applications to Signal Processing," Third Edition, Pear Education. (Indian Edition is available).</li> <li>2. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variate and Stochastic Processes," Fourth Edition, McGraw Hill. (Indedition is available).</li> <li>3. K. L. Chung, Introduction to Probability Theory with Stocha Processes, Springer International Student Edition. G. Hoel, S. Port and C. J. Stone, Introduction to Probability, UBS Publishers</li> <li>4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stocha Processes, UBS Publishers</li> <li>5. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Acade Press.</li> </ul>					
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	HSS elective	Course Code	HS xxx			
ii	Credit structure	LTPC					
		3006					
iii	Prerequisite, if any(for the students)						
iv	Course Content	Will be provided by course instructor					
v	Texts/References	Will be provided by cou	urse instructor				
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Control Systems	Course Code	EE 302		
ii	Credit structure	L T P C 2 1 0 6				
iii	Prerequisite, if any(for the students)	Signals and Systems Co	urse			
iv	Course Content Basic concepts: Notion of Modeling and representat Transfer functions; Blo representations, Performa systems; Characteristic-e domain techniques: Roo Gain-margin and phas Proportional, PI and PID of State-space concepts: Con Minimal representations.	feedback; open- and closed-loop systems. tions of control systems: Ordinary differential equations; ock diagrams; Signal flow graphs; State-space ance and stability: Time-domain analysis; Second-order equation and roots; Routh-Hurwitz criteria, Frequency- ot-locus methods; Frequency responses; Bode-plots; ise-margin; Nyquist plots; Compensator design: controllers; Lead-lag compensators.				
V	<ol> <li>Texts/References</li> <li>Norman S. Nise, Control Systems Engineering, 4th edition, New York John Wiley, 2003. (Indian edition)</li> <li>Franklin, J.D. Powell and A. Emami-Naeini, Feedback Control of Dynamic Systems, Addison Wesley, 1986.</li> <li>I.J. Nagrath and M. Gopal, Control System Engineering, 2nd Edn. Wiley Eastern, New Delhi, 1982.</li> <li>J.C. Doyle, B.A. Francis and A.R. Tannenbaum, Feedback Control Theory, Maxwell Macmilan International Edn. 1992.</li> <li>C.L. Phillips and R.D. Harbour, Feedback Control Systems, Prentice Hall, 1985</li> <li>B.C. Kuo, Automatic Control Systems, 4th Edn. Prentice Hall of India, New Delhi, 1985.</li> </ol>					
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Digita	l Sig	nal Processing	Course Code	EE 304		
ii	Credit structure	LΤ	Ρ	С				
		2 1	0	6				
iii	Prerequisite, if any(for the students)	Signa	ls a	<b>nd System</b> s Co	urse			
iv	Course Content							
	Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals;							
	Discrete systems: attributes, Z-Transform, Analysis of LSI systems, Frequency analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems.							
	Design of FIR Digital filte	rs: Wi	ndo	w method, Par	k-McClellan's n	nethod.		
	Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters.							
	Effect of finite register leng	gth in F	IR f	ilter design.				
	Parametric and non-para signal processing. Application of DSP to Spe	ametric ech an	sp sd R	ectral estimatior adar signal proce	n. Introduction	to multirate		
v	Texts/References							
	1. A.V. Oppenheim a	nd Sch	nafe	r, Discrete Time S	Signal Processii	ng, Prentice		
	2. John G. Proak	is and	D.0	G. Manolakis,	Digital Signal	Processing:		
	Principles, Algorith 3. L.R. Rabiner and Processing Prenti	ims An I B. G ce Hal	d Ap iold	pplications, Prent , Theory and A 192	ice Hall, 1997. pplication of E	)igital Signal		
	4. J.R. Johnson, In	troduct	tion	to Digital Signal	Processing, F	rentice Hall,		
	5. D. J. DeFatta, Processing, J Wile	J. G y and	. Lı Son	ucas and W. S s, Singapore, 198	S. Hodgkiss, I 38.	Digital Signal		
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Digital	Со	mmunications	Course Code	EE 206
ii	Credit structure	L T 2 1	P 0	C 6		
iii	Prerequisite, if any(for the students)	Proba Comn	bili nun	ty and Random ication System	<b>Processes</b> <b>s</b> Course	and
iv	Course Content					
	Review of Random Proc Theory. Optimum detection waveforms- Probability of Intersymbol Interference schemes- Phase Shift Ko Modulation, Continous Ph Modulation tradeoffs. Op channels- Maximum I Equalization Techniques. modulation.	esses on of s of Errc and N eying, ase Mo timum ikelihoo Sync	and sign or e Nyqu Free odul den od hrou	d Spectral analy als in noise. Co valuations. Bas uist criterion. P quency Shift Ke ation and Minim nodulation of dig sequence de nization and C	ysis. Elemen oherent com seband Puls assband Dig eying, Quadra um Shift Keyi gital signals o tection (Vit arrier Recov	ts of Detection munication with e Tranmission- gital Modulation ature Amplitude ing. Digital over bandlimited erbi receiver). very for Digital
v	Texts/References					
	<ol> <li>Wozencraft J. Engineering",</li> <li>Barry J. R., Le Communication</li> <li>Proakis J.G., 2000.</li> </ol>	M. and John V ee E. A on'', Klu ``Digita	d Ja Vile . an uwei I Cc	cobs I. M., ``Prir y, 1965. d Messerschmit r Academic Publ mmunications'',	nciples of Cor t D. G., ``Digi lishers, 2004. 4th Edition, I	nmunication tal VcGraw Hill,
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Po	wer	Sys	stems	Course Code	EE 308
ii	Credit structure	L	Т	Ρ	С		
		3	1	0	6		
iii	Prerequisite, if any(for the students)	Ele	ectri	ical	Machines a	nd Power Electro	nics Course
iv	Course Content						
	Evolution of Power System Basic three phase system Power System Component Lines etc. Modeling, Perfor Formulation/Solution of a Balanced and Unbalanced Positive Sequence Network a load flow solution Introduction to generator as Loss of synchronism Interconnected System Frequency Control, Volta HVDC transmission and F Economic Issues in Powe Analysis of Faulted Power using Sequence Compo Differential and Distance F Preventive Control and Blackouts and Restoration	rms, Energy Sources Structure of Bulk Power Systems n concepts ents: Generators, Loads, Transformers, Transmission ormance and Constraints of these components steady state equations for interconnected systems: ed systems. ork, Per Unit System, Ybus formation Simple example of swing equations and stability issues, Simple Example of Operation and Control: Operational Objectives, age Control and Power Flow Control: introduction to FACTS er Systems. er Systems. er Systems and Protection: Unbalanced System Analysis onents, Equipment Protection Schemes: Overcurrent, Protection, Relay coordination d Emergency Control (System Protection Schemes) on					
v	Texts/References						
	<ol> <li>O.I Elgerd, Ele edition, Tata N</li> <li>A.R.Bergen a Education Asi</li> <li>P.Kundur, Pov</li> </ol>	Electric energy systems theory-An Introduction, 2nd a McGraw Hill, 1982 and V. Vittal, Power Systems Analysis, Pearson Asia, New Delhi, 2002 Yower System Stability and Control, MGraw Hill, 1993					
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Communications Laboratory	Course Code	EE 312
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content	(To supplement Ele Communications Syster Processing Courses)	ectromagneti ns and Di	c Waves, gital Signal
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Control Systems Laboratory	Course Code	EE 314
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
iv	Course Content	(To supplement Control Sys	<b>tems</b> Course)	
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	En	viro	nme	ental Studie	S	Course Code	ES 202
ii	Credit structure	L	Т	Ρ	С	(Half	semester cour	se)
		2	1	0	3			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Multidisciplinary nature of its conservation, Indicator health	fen so	ivirc f er	onm iviro	ental studie onmental pe	es, Eco ollution,	systems, Biod Environment	iversity and and human
	Consumption of natural re coal, minerals, energy, policy and legislation, Env	sou and iror	irce: I la ime	s ar nd) ntal	nd environm , Sustainal impact ass	nental d ble dev sessmer	legradation (for velopment, En nt.	ests, water, vironmental
	Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems, Solid and hazardous waste management (causes, effects and control measures)							
	Air and noise pollution ( Issues including climate depletion, nuclear hazard earthquakes, cyclones and	scie cl ls, l d la	ence nang Disa nds	e ar ge, aste lide	nd enginee global wa r managen s),	ring of arming, nent (in	pollution cont acid rain, o dustrial accide	rol), Global zone layer ents, floods,
V	Texts/References							
	Cunningham W.P. and C Science, Tata McGraw-Hil	unr I Ρι	ning Iblis	han	n M.A. (20 g Company	02), Pr , New E	inciples of En Delhi.	vironmental
	Nathanson, J.A. (2002), E New Delhi.	Basi	сE	nvir	onmental T	echnolo	ogy, Prentice H	lall of India,
	Arceivala, S.J. and Asole Control and Reuse, 3rd Ed	kar, ditio	S.I	R. ( <sup>-</sup> ata	2006), Wa McGraw P	astewat ublishin	er Treatment f Ig Co. Ltd., Nev	or Pollution v Delhi.
	Asolekar, S.R. and Go Management – An Indian 2005.	opic Pe	han ersp	idra ecti	n, R. (20 ve, Founda	05), F ation Bo	Preventive En boks Pvt. Ltd.,	vironmental New Delhi,
	Some selected book-chap	ters	s, m	onc	graphs and	l journa	l papers	
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	En	viro	nme	enta	l Studio	es	Course Code	HS 202
ii	Credit structure	L 2	T 1	P 0	C 3	(Hal	f semest	er course)	
iii	Prerequisite, if any(for the students)	Nil							
iv	Course Content								
	Social Issues and the Indicators of sustainabilit resources: issues and ma	env y, G nag	iron iove eme	me erna ent.	nt, Ince	Public of Na	awarer atural Re	ness and Hur esources - Co	man rights, mmon pool
	Environmental ethics, Re Trends, Environmental Bioregionalism, Environme	eligio mc enta	on oven Il jus	and nen stice	en ts e.	vironm and	ient, Wi Activism	lderness and , Social Ec	Developing ology and
	Environmental economics regulation, Natural resource	, Tr ce a	ade .cco	an unti	d er ing,	nvironn Green	nent, Ec GDP.	onomics of en	vironmental
	Environment and develo Impacts of climate change to climate change.	evelopment, Resettlement and rehabilitation of people ange on economy and society, Vulnerability and adaptatio						of people, I adaptation	
v	Texts/References								
	Agar, N., 2001. Life's Intrii	nsic	Val	ue,	Nev	v York:	Columb	ia University F	ress.
	Dasgupta, P. and Maler, C Development Issues, Vol.	i. (e I, O	ds.) UP.	, (19	997)	, The I	Environn	nent and Emer	ging
	Guha, Ramachandra (200 <i>Debating on Gandhi</i> , in <i>P</i> Press.	)6): \. R	"Ma lagh	ihat nura	ama Ima	a Gand raju (e	lhi and E d.), New	nvironmental Delhi: Oxforo	Movement," d University
	Guha, Ramachandra and and Abuse of Nature in Co	Ma onte	idha mpo	av C orar	Gado Y In	gil (199 dia, Ne	95): Eco ew Delhi	logy and Equit : Penguin.	ty: The Use
	Hanley, Nick, Jason F. Economics in Theory and	S Pra	hog ctic	ren e, N	ar Iew	id Be Delhi:	n White MacMilla	e (2004): En an.	vironmental
	Naess, A. and G. Ses <i>Ecophilosophy</i> , Vol.6.	sion	IS (	(198	34):	"Basi	c Princi	ples of Deep	b Ecology,"
	Redclift, M. and Woodgate Environmental Sociology,	e, G Edv	. (eo varc	ds.) I Ed	, (19 Igar	97), li	nternatio	nal Handbook	of
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	B.Tech	ι. Ρι	roject – I	Course Code	EE 451	
ii	Credit structure	LΤ	Ρ	С			
		0 0	6	6			
iii	Prerequisite, if any(for the students)	None					
iv	Course Content	As assigned by the Project guide /co-ordinator					
v	Texts/References						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	В.1	Tech	. proj	ect – II	Course Code	EE 452
ii	Credit structure	L	Т	Ρ	С		
		0	0	12	12		
iii	Prerequisite, if any(for the students)						
iv	Course Content	As assigned by the project guide / co-ordinator.					
v	Texts/References						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

Semester	I				
Course code	Course Name		Credit st	ructure	
		L	Т	Р	С
CH 101	Chemistry	2	1	0	6
CS 101	Computer Programming & Utilization	2	0	2	6
HS 101 HS 103	English Language Course * Introduction to Philosophy	3	0	0	6
MA 101	Calculus	3	1	0	8
PH 101	Electricity and Magnetism	2	1	0	6
PH 111	Physics Lab.	0	0	3	3
ME 101	Engineering Graphics & Drawing	0	1	3	5
NC 101#	National Cadet Corps (NCC)	0	0	0	P/NP
NO 101#	National Sports Organization (NSO)	0	0	0	P/NP
NS 101#	National Service Scheme (NSS)	0	0	0	P/NP
					40

## Course Curriculum for B.Tech. Programme: Mechanical Engineering Department

\* For students deficient in English Language

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Semester II								
Course Code	Course Name	Credit Structure						
		L	Т	Р	С			
PH 102	Modern Physics	3	1	0	8			
HS 102	Economics	3	0	0	6			
CL 102 EE 102	Introduction to Chemical Engg ( <b>for CL</b> ) Intro. to Electrical and Electronic Circuits* ( <b>for EE and ME</b> )	3	0	0	6			
MA 102 MA 104	Linear Algebra Ordinary Differential Equation - I	3 3	1 1	0 0	4 4			
ME 102	Workshop Practice	0	1	3	5			
CH 112	Chemistry Lab	0	0	3	3			
NC 102#	National Cadet Corps (NCC)	0	0	0	P/NP			
NO 102#	National Sports Organization (NSO)	0	0	0	P/NP			
NS 102#	National Service Scheme (NSS)	0	0	0	P/NP			
					36			

# Any one of these courses to be taken

Semester III						
Course code	Course Name	Credit structure				
		L	Т	Р	С	
ME 201	Solid Mechanics	2	1	0	6	
ME 203	Thermodynamics	2	1	0	6	
EE 207	Electric Circuits	3	1	0	8	
MM 201	Engineering Metallurgy	2	1	0	6	
EE 213	Electrical and Electronics lab.	0	0.5	3	4	
					30	

Semester IV							
Course code	Course Name	C	Credit structure				
		L	Т	Р	С		
ME 202	Strength of Materials	2	1	0	6		
ME 204	Fluid Mechanics	2	1	0	6		
ME 206	Manufacturing Processes – I	2	1	0	6		
MA 204	Numerical Analysis	3	1	0	8		
ME 212	Solid Mechanics Lab	0	0	3	3		
ME 214	Manufacturing Practice Lab	0	1	3	5		
					34		

Semester V					
Course code	Course Name	C	ire		
		L	Т	Р	С
ME 301	Heat Transfer	2	1	0	6
ME 303	Industrial Engineering and Operations Research	2	1	0	6
ME 305	Manufacturing Processes – II	2	1	0	6
HS xxx	HSS core	3	0	0	6
ME 311	Manufacturing Process Lab	0	0	3	3
ME 313	Fluid Mechanics Lab	0	0	3	3
					30

Semester VI									
Course code	Course Name	(	Credit structure						
		L	Т	Р	С				
ME 302	Applied Thermodynamics	2	1	0	6				
ME 304	Kinematics and Dynamics of Machines	2	1	0	6				
ME xxx	Departmental Elective	3	0	0	6				
ES 202	Environmental Studies (Half semester)	3	0	0	3				
HS 202	Environmental Studies (Half semester)	3	0	0	3				
ME 312	Kinematics and Dynamics of Machines Lab	0	0	3	3				
ME 314	Heat Transfer and Metrology Lab	0	0	3	3				
					30				
	HONORS								
ME xxx	Honors Course – 1	3	0	0	6				

Semester VII					
Course code	Course Name	(	ire		
		L	Т	Р	С
ME 401	Machine Design	2	1	2	8
ME 403	Microprocessors and Automatic Control	2	1	0	6
ME xxx	Department Elective – II	3	0	0	6
XX xxx	Institute Elective – I	3	0	0	6
ME 411	Applied Thermodynamics Lab	0	0	3	3
ME 413	Microprocessors and Automatic Control Lab	0	0	3	3
					32
	HONORS				
ME xxx	Honors Course – 2	3	0	0	6
ME xxx	Honors Project (stage – I)	0	0	0	6

Semester VIII						
Course code	Course Name	(	Credit structure			
		L	Т	Р	С	
ME xxx	Department Elective – III	3	0	0	6	
ME xxx	Department Elective – IV	3	0	0	6	
ME xxx	Department Elective - V	3	0	0	6	
ME xxx	Department Elective – VI	3	0	0	6	
XX xxx	Institute Elective – II	3	0	0	6	
					30	
	HONORS					
ME xxx	Honors Project (Stage – II)	0	0	0	12	

## Important Instructions and List of Electives for B.Tech.

- (i) B.Tech. Program consists of 262 credits including 30 credits for Departmental elective and 12 credits of Institute elective courses. (6+2 electives)
- (ii) Each student must select any 6 courses from the departmental elective list I to IV given below.
- (iii) Honors can be earned by completing 2 electives (12 credits) and an 18-credit project. The project, guide and the electives must be decided by the end of semester V. The project should be taken up in the semesters VII and VIII. 2 electives must be slanted towards the project and decided in consultation with the project guide from the list of department electives I to VI given below.

## **Department Electives I to VI**

- ME 3xx Analytical Methods in Engineering
- ME 3xx Computer Aided Solution
- ME 3xx Refrigeration and Air-Conditioning
- ME 3xx Mechanization
- ME 3xx Power Plant Engineering
- ME 3xx Experimental Stress Analysis
- ME 4xx Internal Combustion Engines
- ME 4xx Steam and Gas Turbines
- ME 4xx Industrial Engineering and Operations Research II
- ME 4xx Microfluidics
- ME 4xx Computational Fluid Dynamics and Heat Transfer
- ME 4xx Design for Fatigue and Fracture
- ME 4xx Industrial Tribology
- ME 4xx Fuels and Combustion
- ME 4xx Vibration and Noise Control
- ME 4xx Automobile Engineering (Transmission)
- ME 4xx Non Linear Dynamics and Chaos
- ME 4xx Introduction to Optimization
- ME 6xx Stress Analysis
- ME 6xx Fatigue, Fracture and Failure Analysis \*
- ME 6xx Kinematics and Dynamics of Machinery
- ME 6xx Robotics
- ME 6xx Computer Aided Design of Machines

ME 6xx Machine Design ME 6xx Applied Tribology ME 6xx Finite and Boundary Element Methods ME 6xx Fracture Mechanics \* ME 6xx Rapid Product Development ME 6xx Pressure Vessel Design ME 6xx Mathematical Methods for Applied Mechanics ME 6xx Cryogenics II ME 6xx Linear Systems Theory ME 6xx MEMS: Design, Fabrication and Charaterization ME 6xx Advanced Finite and Boundary Element Methods ME 6xx Convective Heat and Mass Transfer ME 6xx Advanced Heat Transfer ME 6xx Conduction and Radiation Heat Transfer ME 6xx Industrial Noise Control ME 6xx Design for Manufacturing ME 6xx Collaborative Engineering ME 6xx Fundamentals of Gas Dynamics ME 6xx Thermal Environment Engineering ME 6xx Cryogenic I ME 6xx Air-Conditioning System Design ME 7xx Computational Methods in Thermal and Fluids Engineering ME 7xx Computer Integrated Manufacturing ME 7xx Essential of Turbulence ME 7xx Ultra Precision Machining ME 7xx Selected Application of AI & OR in Manufacturing Systems ME 7xx Vibro-Acoustics ME 7xx Sheet Metal Engineering ME 7xx **Textile Machinery and Automation** ME 7xx Numerical Modeling of Manufacturing Processes ME 7xx Casting Design and Simulation ME 7xx Science and Technology of Welding ME 7xx Analysis of Metal Forming Processes ME 7xx Advances in Material Removal Processes EN 6xx Non-Conventional Energy Sources EN 6xx Fuel Cells

- EN 6xx Nuclear Reactor Theory
- EN 6xx Wind Energy Conversion Systems
- EN 6xx Direct Energy Conversion
- EN 6xx Energy Systems Modeling & Analysis
- EN 6xx Solar Energy for Industrial Process Heat
- EN 6xx Utilization of Solar Energy
- EN 6xx Nuclear Reactor Thermal Hydraulics and Safety
- EN 6xx Solar Photovoltaic: Fundamentals, Technologies and Applications
- EN 6xx Power Generation and Systems Planning
- IE 6xx Deterministic Models of Optimization and Operations Research
- IE 6xx Discrete Event System Simulation
- IE 6xx Introduction to Stochastic Models
- IE 6xx Introduction to Financial Engineering
- IE 6xx Engineering Economic Analysis
- IE 6xx Industrial Scheduling
- IE 6xx Quality Engineering and Management Systems
- IE 6xx Applied Integer Programming
- IE 6xx Inventory Control and Management Systems
- IE 6xx System Dynamics Modeling and Analysis
- IE 7xx Neural Networks, Fuzzy Systems and Applications
- IE 7xx Introduction to Knowledge Based Systems and Applications
- IE 7xx Selected Applications of AI in Operations Research
- IE 7xx Quantitative Methods in Project Management
- IE 7xx Pricing and Revenue Management
- IE 7xx Multi-Player Decision Making Models
- IE 7xx Markov Decision Processes
- IE 7xx O.R. Applications in Infrastructure & Service Sectors
- IE 7xx Selected Applications of Stochastic Models
- IE 7xx Quantitative Models for Supply Chain Management

i	Title of the Course	Chemistry				Course Code	CH 101			
ii	Credit structure	L 2	Т 1	P 0	C 6					
iii	Prerequisite, if any(for the students)	Nil								
iv	Course Content									
	Schrodinger equation (origin of quantization), Born interpretation of wave function, Hydrogen atom: solution to Φ-part, MO theory: atomic and molecular orbitals, Structure, bonding and energy levels of diatomic molecules. Examples N2, O2, CO and HF, Configuration, molecular chirality and isomerism, Conformation of alkanes and cycloalkanes, Reactivity of carbonyl group (addition reactions, reactions due to acidic proton, addition-elimination reactions and reactivity of acid halide, ester and amide), Functional group interconversions involving oxidation and reduction, Periodic properties: trends in size, electron affinity, ionization potential and electronegativity, Use of Ellingham diagram and thermodynamics in the extraction of elements, Transition metal chemistry: inorganic complexes, bonding theories, magnetism, bonding aspects and structural distortion, Bioinorganic chemistry: storage and transport proteins, Catalysis: hydrogenation, hydroformylation and olefin metathesis									
v	Texts/References									
	P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006. G.M.Barrow, Physical Chemistry, 5th Edition, Tata McGraw-Hill, New Delhi, 1992. D.A.McQuarrie and J.D. Simon, Physical Chemistry - a molecular approach, Viva Books Pvt. Ltd. (1998). R.T.Morrison and R.N. Boyd, Organic Chemistry, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990 L. G. Wade, Organic Chemistry, Pearson Education 6th Ed, 2006. G. Solomons and C. Fryhle, Organic Chemistry, John Wiley & Sons (Asia) Pte Ltd. M.J.Sienko and R.A.Plane, Chemical Principles and Applications, McGraw Hill, 1980. J.D.Lee, Concise Inorganic Chemistry, 4th Edition, ELBS, 1991. D.D.Ebbing, General Chemistry, Houghton Miffin Co., 1984.									
vi	Instructor(s)name									
vii	Name of other departments to whom the course is relevant	All de	epar	tme	nts					

i	Title of the Course	Computer Programming and Course CS 1 Utilization							
ii	Credit structure	L T P 2 0 2	C 6						
iii	Prerequisite, if any(for the students)	High Sch	ool Mathematics						
iv	Course Content								
	<u>Description:</u> This course provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include:								
	<ul> <li>A. Utilization: Developer fundamentals such as editor, integrated programming environment, Unix shell, modules, libraries.</li> <li>B. Programming features: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o.</li> <li>C. Sample problems in engineering, science, text processing, and numerical methods.</li> </ul>								
V	Texts/References								
	<ol> <li>G. Dromey, How to Solve It by Computer, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982</li> <li>Polya, G., How to Solve _It (2nd ed.), Doubleday and co. (1957).</li> <li>C++ Program Design: An introduction to Programming and Object- Oriented Design. Tata McGraw Hill. Coohoon and Davidson. 3<sup>rd</sup> Edition. 2003.</li> <li>Let`s C. Yashwant Kanetkar. Allied Publishers, 1998.</li> <li>The Java Tutorial, Sun Microsystems. Addison-Wesley, 1999.</li> </ol>								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant	All Depart	ment						
i	Title of the Course	Economics	Course Code	HS 102					
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ii	Credit structure	LTPC							
		3 0 0 6							
iii	Prerequisite, if any(for the students)	None							
iv	Course Content								
	Basic economic problems. Resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balace payments, stabilization policies: Monetary, Fiscal and Exchange rate policies.								
v	Texts/References								
	1. P. A. Samuelson &	W. D. nordhaus, Econo	mics, McGraw H	lill, NY, 1995.					
	<ol> <li>Koutsoyiannis, M and D. L. Rubinf NY, 1989.</li> </ol>	odern Microeconomics, eld, Microeconomics, M	Macmillan, 197 Iacmillan publish	5. R. Pindyck ning company,					
	3. R. J. Gordon, Mac 1987. William F. S	croeconomics 4th edition Shughart II,	, Little Brown an	d Co., Boston,					
	4. The Organization	of Industry, Richard D. In	win, Illinois, 1990	0.					
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant	All Departments							

i	Title of the Course	Cal	culu	IS		Course code	MA 101	
ii	Credit structure	L 3	T 1	P 0	C 8			
iii	Prerequisite, if any(for the students)	Nor	ne					
iv	Course Content							
	Review of Limits, continuit	y, di	ffere	entia	ability.			
	Mean value theorem, Tayl	ors <sup>-</sup>	The	orer	n, Maxima and I	Minima.		
	Riemann integrals, Fund applications to area, volum	dam ne	enta	al ti	heorem of Ca	lculus, Improp	er integrals,	
	Convergence of sequence	es ar	nd s	erie	s, power series.			
	Partial Derivatives, gradient and directional direvatives, chain rule, maxima and minima, Lagrange multipliers.							
	Double and Triple integrat	ion,	Jac	obia	ins and change	of variables for	mula.	
	Parametrization of curves	and	sur	face	es, vector Fields	, Line and surfa	ce integrals.	
	Divergence and curl, Theo	orem	is of	fGre	een, Gauss, and	d Stokes.		
v	Texts/References							
	1. Hughes-Hallett et a	l, Cá	alcu	lus -	– Single and Mu	<i>ıltivariable</i> (3 <sup>rd</sup> E	dition),	
	2. John-Wiley and Soi 3. James Stewart, Cal	ns (2 Iculu	2003 IS (5	3) i <sup>th</sup> Eo	dition). Thomso	n (2003)		
	4. T.M. Apostol, <i>Calcu</i>	lus,	Volu	ume	s 1 and 2 (2 <sup>nd</sup> E	dition), Wiley E	astern 1980	
	5. G.B.Thomas and R 6. (9 <sup>th</sup> Edition), ISE Re	.L.Fi eprin	inne it. A	y, <i>C</i> ddis	alculus and Ana on-Wesley, 199	alytic Geometry 8.		
vi	Instructor(s)name		,	0.0.10		<u> </u>		
VII	departments to whom	All I	рер	artn	nents			
	the course is relevant							

i	Title of the Course	Ele	ectrio	city a	and	Magnetism	Course code	PH 101
ii	Credit structure	L 2	Т 1	P 0	C 6			
iii	Prerequisite, if any(for the students)	N	one					
iv	Course Content Electrostatics: Coulomb's equation, Poisson's eq dielectrics. Magnetostatics Magnetic Induction: Fara energy in a magnetic displacement current, ele- equations, Poynting vect refraction, absorption and	s la juat s : E ada fiele ctro or, ski	aw, ion, Biot s d, L omag way n de	Gau ele Sava law, CR gneti ze p	uss ectro art's Le cir c w rop	theorem, e ostatics wit law, Ampere nz's law, s cuit, resona aves, plane agation thro	electric potenti h conductors, e's law, Lorentz elf and mutua ance. Maxwell' wave solutions ugh a bounda	al, Laplace's capacitors, force. I inductance, s equations: of Maxwell's ry, reflection,
v vi	Texts/References 1. A.S. Mahajar McGraw Hill, 2. D. Griffiths, Ir 1989. Instructor(s)name	n ai 198 htro	nd A 39. Iduct	A. Ration	ang to E	awala, Elec Electrodynan	tricity and Mag nics, 2nd ed., F	netism, Tata Prentice Hall,
vii	Name of other departments to whom the course is relevant	All	dep	artm	ient	S		

i	Title of the Course	Chemistry Lab	Course code	CH 112					
ii	Credit structure	LTPC		1					
		0 0 3 3							
iii	Prerequisite, if any(for the students)	None							
iv	Course Content	se Content							
	Experiments illustrating the concepts of								
	(1) Galvanic cells,								
	(2) Thermo chemistry								
	(3) Chemical kinet	ics							
	(4) Equilibrium cor	nstant							
	(5) Analysis by oxi	dation reduction titration.							
v	Texts/References								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant	All departments							

i	Title of the Course	Engineering Graphics and Drawing			Course code	ME 101		
ii	Credit structure	L 1	Г	Ρ	С			
		0 -		3	5			
iii	Prerequisite, if any(for the students)	None	)					
iv	Course Content							
	Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections. v							
v	Texts/References							
	1. Bhatt N. D. and Panchal V. M., Engineering Drawing, Charotar Publishers, Anand, 2007.							
	2. Luzadder Warren Drawing, Prentice	J. ai Hall (	nd of Ir	Du ndi	ff Jon M., Fu a, 2001.	ndame	ntals o	f Engineering
	3. French Thomas Graphic Technolo	E. and gy, Mo	d V cGr	'ier aw	ck Charles J., Hill, 1993.	, Engin	eering	Drawing and
	<ol> <li>Jolhe Dhananjay Shah M. B. and I (India) Pvt. Ltd, P</li> </ol>	A., E Rana earso	ingi B. ( n E	ine C., du	ering Drawing Engineering I cation,	, Tata Drawing	McGra g, Dorli	aw Hill, 2007. ng Kindersley
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Мо	derı	۱P	hysics	Course Code	PH 102
ii	Credit structure	L 3	T 1	P 0	C 8		
iii	Prerequisite, if any(for the students)	Nor	ne				
iv	Course Content Special theory of relativity viewpoints, Minkowski spa Review of quantum cond photoelectric effect, Com group velocity, Davisso Heisenberg uncertainty pr Schrödinger equation, pro One dimensional problem tunneling, harmonic oscilla Hydrogen atom. Elements of statistical F Fermi-Dirac distributions.	: Ga ace a pton n ( babi s-pa ator.	lilea and s, [ Ger ble. illisti	an a fou Blac fect me c ir le i	and Lorentz tran ir vectors, ener ck body radiat , matter waves r experiment, nterpretation of n a box, potent faxwellian dist	nsformation, sp gy momentum ion, particle na s, wave packet Franck-Hertz wave function. tial well, potent ribution, Bose	ace time conservation. ature of light, is, phase and experiment, ial barrier and
V	<ul> <li>Texts/References</li> <li>1. H.S. Mani and G.K. Mehta, Introduction to Modern Physics.</li> <li>2. S.H. Patil, Elements of Modern Physics.</li> <li>3. K.S. Kane, Modern Physics</li> <li>4. Beiser, Concepts of Modern Physics</li> </ul>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant	All I	Dep	oart	ments		

i	Title of the Course	Int	rodu	ictic	on to Philosophy	Course Code	HS 103	
ii	Credit structure	L	Т	Ρ	С	I		
		3	0	0	6			
iii	Prerequisite, if any(for the students)	No	ne					
iv	Course Content							
	The course will acquaint issues on the nature an ethical issues arising ou objective is to develop issues relating to the foll Growth of scientific kno science. Conceptual evo science: induction, falsifi scientific laws and theori Relationship between s Nature of scientific expla model. Selected case st mathematical reasoning: axioms: formal axiomatic completeness. Nature of axiomatic systems and pr understanding of mind an and cognitivist. Ethics: I elements of environmenta	will acquaint the students of science and engineering with some he nature and methods of science and mathematics, and the s arising out of the application of science and technology. The to develop a critical, reflective and historical awareness on the ng to the following topics: Philosophy and History of Science: scientific knowledge: factors leading to the emergence of modern nceptual evolution: internal and external history. Methodology of luction, falsificationism, confirmation and probability. Nature of s and theories: realism, instrumentalism and underdetermination. between scientific observation, experiment and scientific theory. ientific explanation: teleological explanations and the covering law cted case studies on scientific theories. Logic and the nature of I reasoning: Inductive and deductive forms of reasoning. Nature of sal axiomatic systems. Concept of consistency, independence and s. Nature of rules of inference and proof. Selected examples of stems and proof procedures. Cognition: Current approaches to the g of mind and mental processes: empiricist, rationalist, behaviourist st. Ethics: Impact of science and technology on man and society:						
V	Texts/References							
	<ol> <li>A.C. Grayling (Ed. University Press, Lo</li> <li>Marx W. Wartofsky Introduction to the P</li> <li>I.B. Cohen, The Birth</li> <li>H. Eves and C.V. N Mathematics, Boston</li> <li>K.E. Goodpaster ar Century, Univ. of No</li> <li>S.D. Agashe, A.Guj Technology and Soc</li> </ol>	<ul> <li>(Ed.) Philosophy; A Guide through the subject, Oxford s, Londown, 1995.</li> <li>Jofsky, Conceptual Foundations of Scientific Thought: An the Philosophy of Science, Macmillan, London 1968.</li> <li>Birth of a New Physics, Penguin Books, 1985.</li> <li>V. Newsom, Foundations and Fundamental Concepts of Boston, PWS-Kart Pub. Co., 1990.</li> <li>Jer and K.M. Sayre (Eds.) Ethics and Problems of 21st of Notre Dame Press, London, 1979.</li> <li>A.Gupta and K. Valicha (Eds.) Scientific Method, Science, d Society: A Book of Beadings. Univ. of Bombay Press 1980.</li> </ul>						
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant	All	Dep	artm	nents			

i	Title of the Course	Int Ele	rodı ectro	uctio onic	on to Electrical and Circuits	Course code	EE 102			
ii	Credit structure	L 3	Т 0	P 0	C 6					
iii	Prerequisite, if any(for the students)	No	ne							
iv	Course Content									
	Introduction, basic physical laws, circuit elements, KVL, KCL, and a few									
	important circuit theorem	s, s	imp	le c	ircuits,					
	Transients in R-L, R-C, R-L-C, Sinusoidal Steady State, Real/Reactive Power,									
	Three Phase Working F	ree Phase Working Principles of Transformers/AC/DC machines Functional								
	Characteristics of Diode	ode, BJT, OP-AMP Analog circuit Examples: rectifiers,								
	amplifiers, oscillators etc	:. D	igita	ıl C	ircuits: AND/OR gates,	Flip Flops,	DAC/ADC			
	etc.									
v	Texts/References	1	. Viı F	ncei und	nt Del Toro, `Electrical E lamental, Prentice Hall,	ngineering 1989				
		2	. K. a E	A.K nd I aste	rishnamurthy and M.R.F Electronics Engineering ern Ltd., 1993.	aghuveer, for Scientis	`Electrical ts', Wiley			
vi	Instructor(s)name									
vii	Name of other departments to whom the course is relevant									

i	Title of the Course	Lin	ear	Alg	ebra	Course Code	MA 102
ii	Credit structure	L 3	Т 1	P 0	C 4		
iii	Prerequisite, if any(for the students)	No	ne				
iv	Course Content						
	Vectors in R <sup>n</sup> , notion of li set of vectors, vector subs	nea spac	r in ces	dep of R	endence ar <sup>n</sup> , basis of a	nd dependence, a vector subspace	linear span of a e.
	<ul> <li>Systems of Linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix.</li> <li>Determinants and rank of a matrix in terms of determinants.</li> <li>Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem.</li> <li>Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation.</li> <li>Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal).</li> <li>Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, applications to quadratic forms.</li> </ul>						
V	Texts/References						
	<ol> <li>H.Anton, <i>Elementary linear algebra with applications</i> (8<sup>th</sup> ed.), John Wiley (1995)</li> <li>G.Strang, <i>Linear algebra and its applications</i> (4rh Ed.), Thomson (2006)</li> <li>S.Kumaresan, <i>Linear algebra – A Geometric approach</i>, Prentice Hall of India (2000)</li> <li>E.Kreyszig, <i>Advanced Engineering Mathematics</i> (8<sup>th</sup> Ed.), John Wiley (1999)</li> </ol>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Ordinary Differential Equations - I	Course code MA 104				
ii	Credit structure	L T P C 3 1 0 4					
iii	Prerequisite, if any(for the students)	None					
iv	Course Content Exact equations, i Orghogonal trajec Lipschitz condition Linear differential Linear dependence Diamensionality o Linear ODE's with Cauchy-Euler equ Method of undete Method of variatio Laplace transform Shifting theorems Convolution theor	, integrating factors and Bernoulli equations. ectories. on, Picard's theorem, examples on nonuniqueness. al equations generalities. nce and Wornskians. of space of solutions, abel-Liouville formula. ith constant coefficients, the characteristic equations. quations. termined coefficients tion of parameters. rm generalities.					
V	<ol> <li>Texts/References</li> <li>E.Kreyszig, Advanced engineering mathematics (8<sup>th</sup> Ed.), John Wiley (1999)</li> <li>W.E.Boyce and R. DiPrima, Elementary Differential Equations (8<sup>th</sup> Ed.) John Wiley (2005)</li> </ol>						
vi	Instructor(s)name	,					
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Workshop	Practice	Course Code	ME 102
ii	Credit structure	L T P 0 1 3	C 5		
iii	Prerequisite, if any(for the students)	None			
iv	Course Content Introduction to wood wo pattern making: types of p bench work & fitting: to machine tools: Safety me like lathe, shaping, & dril tools and their usage, se welding. Assignments: Sir welding, lathe and shaping	rk: hand to patterns, all ols & ope easures, pri ling. Import election of mple assigr g machine v	ools & various o owances, colour rations. Introduct nciples of operati tant operations of cutting speeds, nments in wood w work.	operations. Intro coding. etc. Intro tion to metal o ion of basic ma n these machir feeds, etc. Intro working, fitting,	oduction to roduction to cutting and achine tools res. Cutting roduction to electric arc
v	Texts/References           1)         Elements of Wo           Hajrachoudhury         Mumbai. 14th E           2)         Elements of Wo           Hajrachoudhury         Mumbai. 12th Ec           3)         Workshop Practi	rkshop Tecl & Others, I dition, 2007 rkshop Tecl & Others, I dition, 2007 ce by H. S.	hnology, Vol. I by Media Promoters <sup>7</sup> . hnology, Vol. II by Media Promoters Bawa, Tata-McG	S. K. and Publishers <sup>7</sup> S. K. and Publishers raw Hill, 2004.	,
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant	All Departr	nents		

i	Title of the Course	Physics Lab.	Course code	PH 111
ii	Credit structure	L T P C 0 0 3 3		
iii	Prerequisite, if any(for the students)	None		
lv	Course Content	Error analysis and accuracy Selected experiments from voltage sensitivities of a m measurement of self indu- bridge, resistivity of a th Fresnel biprism, Newton's using Koenig's method, ph Tube, Laser Diffraction, Gr Counter.	of measureme the following: noving coil ga ctance using ermistor, Helr rings. Young ysical pendulu ating Spectron	ent. current and llvanometer, Anderson's mholtz coil. l's modulus um, Kundt's meter, G.M.
V	Texts/References	<ol> <li>B.L. Worsnop and H.T. F Physics for students, As 1971.</li> <li>G.L. Squires, University</li> </ol>	Flint, Advancec ia Publishing H Press, Cambri	l Practical Iouse, idge, 1999.
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i.	Title of the Course	Solid Mech	anics	Course Code	ME 201		
ii.	Credit Structure	L T P 2 1 0	C 6				
iii.	Prerequisite, if any (for the students)	None					
iv.	Course Content (separate sheet may be Introduction. Analysis of and Indeterminate Prot Components. Beams; S Strain Tensors. Mohr O Relations. Basic Equa tension, impact, fatigue of Circular Shaft. Introc of Circular Shaft. Thick	e used, if nec of Axially Loo olems; Castig Shear Force Circle. Stress tions of Ela and creep. duction to Ela Cylinder; Inte	essary) aded Compon- liano's Theore and Bending N -strain Relatio sticity. Materia Strain Rosettes astic-plastic Be erference Fit; F	ents – Statically m. Analysis of S Ioment Diagram ns; Stress-strain I Testing - Prop s. Stresses in Be ending of Beams Rotating Disc.	Determinate shear Loaded s. Stress and -temperature perties under ams. Torsion and Torsion		
v.	<ol> <li>Crandall S. H., Dahl N.C. and Lardner T. J., An Introduction to Mechanics of Solids, McGraw Hill, 1978.</li> <li>Popov E. P., Introduction to Mechanics of Solids, Prentice Hall of India, 1993.</li> <li>Case J. and Chilver A. H., Strength of Materials and Structures, Edward Arnold, 1980.</li> <li>Srinath L. S., Desayi P., Murthy N.S. and Anantha S. Murthy, Strength of Materials, Macmillan India, 1997.</li> <li>Srinath L. S., Advanced Mechanics of Solids, 2<sup>nd</sup> Ed., Tata McGraw Hill, 2003.</li> </ol>						
vi.	Instructor (s)						
vii.	Name of other departments to whom the course is relevant						

i	Title of the Course	Th	erm	ody	namics	Course Code	ME 206		
ii	Credit structure	L	Т	Ρ	С	1			
		2	1	0	6				
iii	Prerequisite, if any(for the students)	Nil							
iv	Course Content								
	Introduction to thermodynal systems. Units and dimensi processes, interactions.	mics	s. . Co	Syst nver	em, surrou sion factors	Indings, boundaries s. Properties of sys	, classification of tems. Equilibrium,		
	The work interaction. Then interaction. Evaluation of work	mod rk.	lyna	mic	definition of	of work. Characteris	stics of the work		
	Adiabatic boundary. Adiabat Basic form. Energy of a syste	ic s em.	syste The	ems hea	and proces t interactior	sses. Adiabatic work n. Sign convention.	. The First Law.		
	Diathermic boundary. Zeroth law. Isothermal states. Empirical temperature. Principles of thermometry. Scales of temperature. Gas thermometer. The ideal gas. Ideal gas temperature scale. The state principle. Equations of state. Properties of gases. Properties of steam. Introduction to steam tables. Other equations of state. Van-der-Waals gas. Critical state. Reduced equation of state.								
	First law for open systems. energy equation.	De	rivat	ion	of the gen	eral form. Special c	ases. Steady-flow		
	The Second Law. Kelvin-Planck and Clausius statements. Equivalence of statements. Carnot theorem. Thermodynamic temperature. Kelvin scale. Carnot engine. Equivalence of thermodynamic Kelvin scale and ideal gas Kelvin scale. Clausius inequality. Definition of entropy. Evaluation of entropy. Principle of increase of entropy. Formulation of second								
	Auxiliary functions. Property state.	rela	atior	ns. N	laxwell's e	quations. Applicatior	ns to equations of		
	Combined first and second la	aws.	Ava	ailabi	lity and exe	ergy. Lost work.			
v	Texts/References								
	<ol> <li>Achuthan M, Engineering Thermodynamics, Prentice-Hall of India, New Delhi, 2002.</li> <li>Sears F. W. and Salinger G. L., Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Addison-Wesley/Narosa, New Delhi, 1975.</li> <li>Moran M. J. and H. N. Shapiro., Fundamentals of engineering Thermodynamics, Third Edition, Wiley, New York, 1995.</li> <li>Zemansky M. W., Heat and Thermodynamics, Fourth Edition, McGraw-Hill Kogakusha, New York/Tokyo, 1957.</li> <li>Mathur M. L. and Mehta F. S., Steam and Other Tables (with Mollier Chart), Revised Edition, Jain Brothers, New Delhi, 2005.</li> </ol>								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Electric C	ircuits	Course Code	EE 207		
ii	Credit structure	L T P 3 1 0	C 8	1	<u>.</u>		
iii	Prerequisite, if any(for the students)	None					
iv	Course Content Introduction, basic physica KVL, KCL, and a few impo Transients in R-L, R-C, F Three Phase Working Principles of Trar Functional Characteristics Analog circuit Examples: r Digital Circuits: AND/OR g	al laws, circ ortant circu ?-L-C, Sin sformers// of Diode, rectifiers, a jates, Flip I	cuit elements, it theorems, simpl iusoidal Steady S AC/DC machines BJT, OP-AMP mplifiers, oscillato Flops, DAC/ADC e	e circuits, tate, Real/React rs etc. etc	ive Power,		
V	<ul> <li>Texts/References</li> <li>1. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 1989</li> <li>2. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', Wiley Eastern Ltd., 1993.</li> </ul>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Engin	eerino	g Metallurgy	Course Code	MM 201	
ii	Credit structure	L T 2 1	P 0	C 6			
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content Introduction and classifica Alloys. Iron-carbon Phas Principles of Heat Treatn Properties and Industrial a and cast irons. Properti bronzes, aluminium and it Mechanical behavior of fatigue and creep behavior	ation of se Diag nent of applica es anc s alloys metals. r of me	Engi grams Stee tions I use s, zino co co etals.	neering Materia c. Classificatio els and alloys. of alloys steels s of non-ferrou c, tin alloys, nick ld and hot wo Corrosion and	als. Structure n and Propert Case-Harden , tool steels, st s materials – kel and titaniun rking of meta its prevention.	of Metals and ties of Steels. hing of steels. tainless steels Brasses and n alloys. Ils. Fracture,	
V	<ul> <li>Texts/References</li> <li>1. R.E. Reed-Hill: Physical Metallurgy Principles, 4<sup>th</sup> Edition</li> <li>2. Cengage Learning, 2003</li> <li>3. F.C. Compbell 'Elements of Metallurgy and Engineering Alloys", ASM International, Ohio, 2008</li> <li>4. R.E. Smallman, A.H.W. Nagan, "Physical Metallurgy and Advanced Materials", Seventh Edn, Elsevier, 2007</li> <li>5. William D Callister, Jr., "Materials Science and Engineering", Wiley India (P) Ltd., 2007</li> <li>6. D.A. Porter and K.E. Easterling, Phase Transformations in Metals and Alloys, second edition, Chapman and Hall, London 1992</li> </ul>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Experimental Engineering Lab	Course Code	ME 211
ii	Credit structure	L T P C 0 0.5 3 4		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Principles of experimenta designing of experi Experiments in fluid n materials.	al investigation, ments, error nachinery and	planning and estimation. strength of
v	Texts/References			
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Strength of Materials	Course Code ME 202
ii	Credit structure	L T P C 2 1 0 6	
iii	Prerequisite, if any(for the students)	Solid Mechanics	
iv	Course Content Introduction. Bending of ( Box Sections. Deflection function, Energy Principle theorem, etc.), Superpos Continuous Beams. Buc Formulae. Theories of F Bending of Thin Plates ar Circular Plates. Photoelas	Curved Bars. Unsymmetrical of Beams - Methods based es (virtual work, minimum po ition Principle, etc. Statically ckling - Euler Load, Seca ailure. Introduction to Griffith nd Shells. Thermal Stress Ana sticity.	Bending. Torsion of Thin on integration, Singularity otential energy, reciprocal Indeterminate Problems. ant and Rankine-Gordon th Theory. Introduction to alysis for Rectangular and
V	<ol> <li>Texts/References</li> <li>Crandall S. H., Dah of Solids, McGraw I</li> <li>Popov E. P., Introdu 1993.</li> <li>Case J. and Chilven Arnold, 1980.</li> <li>Srinath L. S., Advar Hill, 2003.</li> <li>Timoshenko S. P. a Students Edition, M</li> </ol>	II N.C. and Lardner T. J., An Hill, 1978. Lotion to Mechanics of Solids, r A. H., Strength of Materials a nced Mechanics of Solids, 2 <sup>nd</sup> and Goodier J. N., Theory of IcGraw Hill, 1982.	Introduction to Mechanics Prentice Hall of India, and Structures, Edward Edition, Tata McGraw Elasticity, International
vi	Instructor(s)name		
vii	Name of other departments to whom the course is relevant		

i	Title of the Course	Fluid Mech	nanics	Course Code	ME 204				
ii	Credit structure	LTP	С		<u></u>				
		2 1 0	6						
iii	Prerequisite, if any(for the students)	NIL							
iv	Course Content								
	Domain of Fluid mechanics, Co of continuum, chain rule, Differe Tensor, Stream line, Streak line, viscosity, Newtonian and Non-No	ncept of Conti ntial-Integral a path line and t ewtonian, kine	nuum, Mean free analysis, dimensi time line, thermo matic viscosity, s	e path, Knudsen nur onality of the proble dynamic properties, surface tension and o	mber, applicability m, Scalar, Vector, equation of state, contact angle.				
	Pascal's law, Hydrostatic equ Manometry, Buoyancy, Stability rotation.	ation, Force of floating obje	on planar surf ects, pressure dis	aces, Force on a stribution in solid bo	curved surface, dy translation and				
	Reynolds transport theorem, ( accelerating control volumes. ( volumes.	Conservation Conservation	of mass, linear of angular mom	momentum, for fix nentum and energy	ked, moving and for fixed control				
	Acceleration of a particle, Substantial derivative, Derivation of mass balance for incompressible flow, Concept of linear deformation and physical interpretation of mass balance, Angular deformation, vorticity and irrotational flow, Momentum equations for Cartesian coordinates, generalization to vector forms, Generalized Newtonian Stress-Strain relation (just statement), Navier-Stokes Equations, Concept of stream function, Bernoulli's equation, stagnation pressure, Pitot tube, Energy grade lines.								
	Buckigham $\pi$ theorem, Non-dim	ensionalizatior	n of governing ec	quation, Modelling ar	nd similitude.				
	Fully developed flow between p Darcy), Introduction to turbulent flow (law of wall, Moody's plot hydraulic diameter for non-circu venturis.	arallel plates a t flow and the ), minor losse ular pipe, flow	and pipe flows, C problem of clos s in fittings, pip measurement u	concept of friction fau ure, empirical treatm es in series and pa using orifice plates,	ctor (Fanning and nents of turbulent arallel, concept of flow nozzles and				
	Derivation of isentropic law, Pulse propagation speed in ideal gas, Mach cone, Compressible frictionless flow in a variable area system. Flow in a C-D Nozzle, Choking, Normal shocks. Concept of a boundary layer, Displacement and momentum thickness definitions, Momentum integral equation for flat plates and its solution to estimate drag coefficient, similarity transformation and its application for flat plate, empirical equations for turbulent flow. Introduction to separation, vortex shedding, drag in cylinders, sphere, lift and drag in aerofoils (purely qualitative treatment with just final relations for solving some typical problems). Introduction to pumps and turbines (classification and types), General characteristics, Homologous								
v	Texts/References								
	<ol> <li>Fox R.W. and McDonald A.T., Fluid Mechanics, John Wiley International, 2005.</li> <li>White F. M., Fluid Mechanics, Tata McGraw Hill, 2008.</li> <li>Gupta V. and Gupta S.K., Fluid Mechanics, Narosa, 2005.</li> </ol>								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Manufacturing Processes – I	Course Code	ME 206				
ii	Credit structure	L T P C 2 1 0 6						
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content Casting processes: dispensable and permanent mould processes; analysis of melting, pouring and solidification phenomena; design of pattern, core, feeder and gating system; casting defects and inspection. Joining processes: fusion and solid-state welding; brazing and soldering; weld joint design, cooling rate, and joint properties; welding defects and inspection. Bulk and Sheet Forming processes: rolling, forging, extrusion and drawing; sheet metal working; forming limit diagram; loads, friction and lubrication; forming defects and inspection. Powder processing: Powder manufacture, characterization, compaction and sintering; metal injection moulding; hot and cold isostatic pressing. Polymers and Composites: Thermoplastics, thermosets, elastomers and composites; related processes; injection mould design; moulding defects and inspection. Advanced processes: Free form fabrication (rapid prototyping), and net shape manufacturing processes.							
V	<ol> <li>Texts/References</li> <li>Ghosh A. and Mallick A. K., Manufacturing Science, Affiliated East West Press, 2001.</li> <li>Rao P. N., Manufacturing Technology- Foundry, Forming and Welding, Tata McGraw Hill, 1987.</li> <li>Schey J., Introduction to Manufacturing Processes, Tata McGraw Hill, 2000.</li> <li>DeGarmo E. P., Black J. T. and Kohser R. A., Materials and Processes in Manufacturing, Prentice Hall India, 1997.</li> <li>Pye R. G. W., Injection Mold Design, Longman Scientific &amp; Technical, Essor, 1989.</li> </ol>							
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Nu	mei	rical	Analysis	Course Code	MA 204
ii	Credit structure	L 3	T 1	P 0	C 8		
iii	Prerequisite, if any(for the students)						
iv	Course Content						
	Interpolation by polyno polynomial, piecewise	omi line	als, ear	divi and	ded differences cubic spline in	s, error of the inter terpolation.	polating
	Numerical integration,	CO	mpc	osite	rules, error for	rmulae.	
	Solution of a system of elimination and Gauss factorization Cholesky	of lir s-se v's n	near eidel neth	equ me nod,	uations, implen thods, partial p ill-conditioning	nentation of Causs pivoting, row echelo , norms.	ian on form, LU
	Solution of a nonlinea	r eo	luat	ion,	bisection and	secant methods.	
	Newton's method, rate equations, numerical Runge-Kutta methods order of convergence, elliptic, parabolic and	e of solu , m fini hyp	cor ition ulti- ite c erbo	nver n of step liffe olic	gence, solutior ordinary differe o methods, pred rence methods partial different	n of a system of no ential equations, Eu dictor-corrector me , numerical solutio tial equations.	nlinear ıler and thods, ns of
	Eigenvalue problem, p	oow	er n	neth	od, QR metho	d, Gershgorin's the	eorem.
	Exposure to software	pac	kag	es l	ike IMSL subro	outines, MATLAB	
v	Texts/References 1. S.D.Conte an Algorithmic Ap 2. C.E. Forberg Addison-Wesl 3. E.Kreyszig, A Wiley (1999)	<ul> <li>S.D.Conte and Carle de Boor, Elementary Numerical Analysis – An Algorithmic Approach (3<sup>rd</sup> Edition), McGraw-Hill, 1980</li> <li>C.E. Forberg, Introduction to Numerical Analysis (2<sup>nd</sup> Edition), Addison-Wesley, 1981</li> <li>E.Kreyszig, Advanced engineering mathematics (8<sup>th</sup> Edition), John Wiley (1999)</li> </ul>					
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Solid Mechanics Lab	Course Code	ME 212			
ii	Credit structure	L T P C 0 0 3 3					
iii	Prerequisite, if any(for the students)	Solid Mechanics					
iv	Course Content Experiments associated w testing, fatigue testing and gaging and photoelasticity	with tensile testing, torsic d impact testing. Experim v.	on testing, buck nents on beam	kling, hardness bending, strain			
V	<ol> <li>Texts/References</li> <li>Crandall S. H., Dahl N.C., and Lardner T. J., An Introduction to the Mechanics of Solids McGraw Hill, 1978.</li> <li>Dally J. W. and Riley W. F., Experimental Stress Analysis, McGraw Hil 1987.</li> <li>Doebelin E. and Manik D. N., Measurement Systems, McGraw Hill Educations 2007.</li> </ol>						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Ma	anuf	actu	rring Practice Lab	Course Code	ME 214
ii	Credit structure	L 0	T 1	P 3	C 5		
iii	Prerequisite, if any(for the students)	Nil					
iv	Course Content Study of sand casting pu melting, pouring and fettli forming equipments; Ge grinding, etc.; Semi-auton Manufacturing and fitting specifications.	roce ng; ner; natio pra	ess Ga: al p c an ctic	flow s, Ai ourp id ai e of	and equipment for rc and Resistance vo ose machine tools utomatic machines. a machine subasso	or molding, cor welding equipm 3: lathe, milling embly according	e-making, ent; Metal g, drilling, g to given
V	Texts/References 1. DeGarmo E.P., Bl Manufacturing, Pr 2. HMT Production T	ack rent Fech	ice nnol	. an Hall ogy,	d Kohser R.A., Mate India, 1997. Tata McGraw Hill,	erials and Proce 1980	esses in
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Heat Transfer	Course Code	ME 301					
ii	Credit structure	LTPC							
		2 1 0 6							
iii	Prerequisite, if any(for the students)	Fluid Mechanics, Thermoo	lynamics						
iv	Course Content								
	Introduction to conduction Isotropic and anisotropic of governing equation in spherical coordinates.; Of thermal resistance, com generation.; Fins; Evalua Two-dimensional steady conduction: lumped cap convection: Prandtl and equation. ; Momentum Thermal boundary layer; energy equation. Moment flat plate; Analogy betwee flows; Thermal entry len Free convection from pla Similarity and integral so cases; Mixed convection; Radiation: Basic concepts; Planck, angle; radiation intensity. Definition, common config surfaces. ; Heat Exchange Fouling factor.; Design a using e - NTU method - De	<ul> <li>tion: Fourier law; Thermal conductivity and diffusivity;</li> <li>ic materials; Boundary and initial conditions. ; Derivation in Cartesian coordinate; Equations in cylindrical and One-dimensional steady state conduction: Plane walls, omposite walls, radial systems, critical radius, heat uation of fin performance; Thermal contact resistance.; y state conduction: separation of variables. ; Transient apacitance, semi-infinite solid model. ; Introduction to id Nusselt numbers ; Derivation of differential energy n boundary layers; Similarity solution for flat plate. ; er; Pohlhausen similarity solution for flat plate. Integral enum integral equation. Von Karman integral solution for reen heat and momentum transfer. ; Heat transfer in pipe ength; Correlations for some common configurations. ; olate: Governing equations and non-dimensionalization. ; solutions for vertical plate. ; Free convection for other n; Introduction to pool boiling; correlations.</li> <li>k, Wien and Stefan-Boltzmann laws. Irradiation; solid y. ; Heat exchange between two surfaces. Shape factor: figurations. Radiation exchange between two diffuse-gray ngers. ; Applications and classification of heat xchangers;</li> </ul>							
v	Texts/References								
	<ol> <li>Ghoshdastida Delhi, 2004.</li> <li>Sukhatme S. Press, Hydera</li> <li>Incropera F. F Transfer, 5th I</li> </ol>	<ol> <li>Ghoshdastidar P.S., Heat Transfer, Oxford University Press, New Delhi, 2004.</li> <li>Sukhatme S. P., A Textbook of Heat Transfer, 4th Ed., Universities Press, Hyderabad, 2005.</li> <li>Incropera F. P. and Dewitt D. P., Fundamentals of Heat and Mass Transfer, 5th Ed., Wiley and Sons, ew York, 2002.</li> </ol>							
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Industrial Engineering and Operations Research	Course Code	ME 303
ii	Credit structure	L T P C 2 1 0 6		
iii	Prerequisite, if any(for the students)	NIL		
iv	Course Content Introduction to Industrial E Capacity planning. Locati Manufacturing planning co planning, and aggregate p Introduction to concepts Programming: problem duality and sensitivity an methods including transpo path problem. Integer pro Introduction to applied variables and their probabilities/expectations. performance.	ingineering, Work-time study on and layout models for fact oncepts based on forecasting planning. Basic inventory mo of operations research a formulation, simplex method alysis, Interior point method ortation and assignment mod gramming models, branch ar probability models for dec distributions. Independ Expectations, variances a	and productivit tories and ware g, push and pu dels. and optimization d, concept of ds Network flo els, min-cost flo nd bound metho cision making. dence and nd probabilistic	ty. shouses. Il models of primal-dual, w model & ow, shortest od Random conditional c notions of
V	<ul> <li>Texts/References</li> <li>Taha H. A., Opera 2004.</li> <li>Bazaraa M. S., Ja Network Flows, 2n</li> <li>Hillier F. S. and Li 8th Ed., McGraw</li> <li>Nahmias S., Prod</li> <li>Lawrence J. A., Jr 2nd Ed, Wiley, 20</li> <li>Krajewski L. J. an Analysis, 6<sup>th</sup> Ed., 1</li> <li>Hopp Wallace J. a McGraw Hill, 2000</li> </ul>	tions Research: An Introduct rvis J. J. and Sherali H. D., L nd Ed., Wiley, 1990. eberman G. J., Introduction to Hill, 2004. uction and Operations Analys and Pasternack B.A., Applie 04. d Ritzman L. P., Operations N Pearson Education, 2002. and Spearman Mark L., Facto D.	ion, 8th Ed., M inear Program o Operations F sis, McGraw Hi ed Managemen Management: S ory Physics, 2nd	lcGraw Hill, aming & Research, II, 1997. It Science, Strategy and d Ed.,
vi vii	Instructor(s)name Name of other departments to whom the course is relevant			

i	Title of the Course	Manufacturing Processes – II	Course Code	ME 205			
ii	Credit structure	LTPC					
		2 1 0 6					
:=	Prerequisite, if any(for the students)	NIL					
iv	Course Content						
	<ul> <li>iv Course Content</li> <li>Fundamentals of Material Removal Processes: Chip formation, tool geometry and materials, mechanics of machining, Tool temperature, Tool wear, Tool-life Surface finish, Machinability, Economics of machining.</li> <li>Fundamentals of Machine Tools: General-purpose, semi-automatic and Automatic machine tools, Set-ups and operations on - Lathe, Drilling, Milling Grinding, Broaching machines; Machining processes for production: Gear cutting (Hobbing and Shaping), Thread cutting, Centerless grinding; Finishing operations: Honing, Lapping, etc.</li> <li>Introduction to Jigs and Fixture Design: Principles of location and clamping. Non-conventional Machining Processes: Electric discharge Machining (EDM) Electrochemical Machining, LASER and Abrasive Flow Machining, etc.</li> <li>Dimensional Metrology: Limits, Fits and dimensional tolerances; Design of limi gages, Taylor's principle, Gage tolerancing; Geometrical tolerances of form orientation, position, location, run-out; Basic definitions and measuremen principles, MMC/RFS conditions.</li> <li>Comparators and Metrological Instruments: Principles of optical, pneumatic electric/electronic instruments; Inspection of gears and screw threads; Surface finish and its measurement, Coordinate Dimensional metrology, CMM construction and operation</li> </ul>						
V	Texts/References						
	1. Boothroyd G. and Machine Tools, M	Knight W. A., Fundamentals of Maarcel Dekker, 1989.	achining an	d			
	<ol> <li>Ghosh A. and Mal</li> <li>HMT Production T</li> </ol>	lick A. K., Manufacturing Science, echnology, Tata-McGraw Hill, 198	, Affiliated E 30.	WP, 2001.			
	<ol> <li>Gayler J. F. W. an</li> <li>Foster L. W., Geo Techniques, Addis</li> </ol>	d Shotbolt C. R., Metrology for Er metrics II, the Application of Geon con-Wesley, 1986.	igineers, El netric Tolera	_BS, 1990. ancing			
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	H S S Core	Course Code	HS xxx
ii	Credit structure	LTPC		
		3 0 0 6		
iii	Prerequisite, if any(for the students)			
iv	Course Content	Will be provided by the cour	se instructor	
v	Texts/References	Will be provided by the cour	se instructor	
vi	Instructor(s)name			
vii	Name of other departments to whom the course is relevant			

i	Title of the Course	Manufacturing Process Lab. Course Code ME 311
ii	Credit structure	L T P C 0 0 3 3
iii	Prerequisite, if any(for the students)	Manufacturing Processes I
iv	Course Content	Experiments on casting, metal forming, welding and machining processes; Assessment of manufactured components; Machine capability study.
V	Texts/References	<ol> <li>Ghosh A. and Mallick A.K., Manufacturing Science, Affiliated East West Press, 1985.</li> <li>Boothroyd G. and Knight W. A., Fundamentals of Machining and Machine Tools, Marcel Dekker, 1989.</li> </ol>
vi	Instructor(s)name	
vii	Name of other departments to whom the course is relevant	

i	Title of the Course	Fluid Mechanics Lab	Course Code	ME 313			
ii	Credit structure	L T P C 0 0 3 3					
iii	Prerequisite, if any(for Fluid Mechanics the students)						
iv	<ul> <li>Course Content</li> <li>Observation of flo flow over circular</li> <li>Measurement of la</li> <li>Friction factor m Reynolds number</li> <li>Pressure and velo</li> <li>Measurement of di</li> <li>Losses in pipe fitti</li> <li>Experiments on a diffusers.</li> <li>Characteristics of Measurement of f</li> </ul>	ow regimes and pressure distribution measurement for cylinder. laminar velocity profile and friction factor in pipe flow. neasurement in turbulent flow in pipes for different r. ocity distribution measurements in submerged jet. convergent-divergent nozzle characteristics. lift and drag on an airfoil (single and cascade). tings. a hydraulic trainer and pressure distribution in curved f labyrinth seals. force due to impact of jets.					
v	Texts/References 1. Fox R.W. and McDonald A.T., Fluid Mechanics, John Wiley Internation 2005.						
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	App	olie	d Th	nermodynamics	Course Code	ME 302
ii	Credit structure	L 2	T 1	P 0	C 6		
iii	Prerequisite, if any(for the students)	The	ərm	ody	namics		
iv	Course Content Introduction to the Course Engines.; Recap of I law as Open/Closed, Refrige Internal combustion/ exter work, thermal efficiency, h output, mean effective pro Carnot vs. other cycles. mixture, lean mixtures). ; fuel, Estimation methods Apparatus.; Otto Cycles, Dual cycle, p-theta dia Combustion and knockin explanation of various te Modifications to Rankine separators/ application Compression and Reverse Psychrometry.; Reciprocation	e, G for ( erati erna heat s fo Die grar ng i rms cyc of e Br, ting,	ene Clos ion/ I co rate rate sel m. r C sel m. Ra ayte , rot	eral Sed Pov omb e, s vol eral of fo Calor Cl e odifi Fe on C cary	Scheme of things, and Open System ver, Multi-compon ustion, etc.; Perfor pecific fuel consum umetric efficiency, stoichiometry and rmation, Heat of re- rific values, Exha cles, Air-standard combustion and engine. ; Carbure cations of Brayton eed Water Heater ne to Nuclear p Cycles Vapour Abso and centrifugal Co	Energy Resounds. Classification ent/ Single- or prmance paramention, work rate COP, refrigerand definition of the eaction, Calorific ust Gas Analy cycles and Act knocking in St tion.; Brayton in cycle. ; Rand source plants. proption Cycles. mpressors.	arces, Heat n of cycles component, neters: Net io, specific tion effect. terms (rich ic Value of vsis, Orsat ual cycles, cycle with kine cycle. cycle with kine cycle. ; Vapour
v vi	Texts/References 1. Moran M. J. al Thermodynamics, 2. Cengel Y. A. and Approach, McGra 3. Dossat R. J. an Education, 4 <sup>th</sup> Indi 4. Arora C. P., Refrig 2003. Instructor(s)name	nd Thi d w H d F ian I gera	H. Bol ill, 3 Iora Rep tion	N. Editi es 3 <sup>rd</sup> E an orint i and	Shapiro., Funda on, Wiley, New Yo M. A., Thermodyr Ed., 1998 F. J., Principles c , 2004. d Air-conditioning,	amentals of E ork, 1995. namics: An E of Refrigeration Tata McGraw H	ingineering ingineering i, Pearson lill, 2 <sup>nd</sup> Ed.,
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Kine Mac	ema chin	atic Ies	s and Dynamics of	Course Code	ME 304
ii	Credit structure	L <sup>-</sup> 2	T 1	P 0	C 6		
iii	Prerequisite, if any(for the students)	NIL					
iv	Course Content Introduction to Mechanisn Cam Follower Mechanisn Epicyclic Gear Trains. Dy Applications of Discrete an	ns. P ms. nam nd C	osit Gea ic A onti	tior ar t ana inu	n, velocity and accel tooth profiles, spur lysis of Mechanisms ous System Vibratio	eration analysi gears and he s. Balancing. A n.	s. Design of elical gears. analysis and
V	<ol> <li>Texts/References</li> <li>Paul B., Kiner Hall, 1979.</li> <li>Tse F. S., Mor Publishers an</li> <li>Rao J. S. and Eastern, 1984</li> <li>Den Hartog J.</li> <li>Uicker J.J., Pu Mechanisms,</li> <li>Rattan S.S., To Delhi, 2005.</li> <li>Norton, R.L., New Delhi, 2005.</li> </ol>	ematics and Dynamics of Planar Mechanisms, Prentice orse I.E. and Hinkle R. T., Mechanical Vibrations, CBS and Distributors, 1983. Id Gupta K., Introductory Course on Vibrations, Wiley 34. J. P., Mechanical Vibrations, McGraw Hill, 1956. Pennock G.R. and Shigley J.E., Theory of Machines an s, 3 <sup>rd</sup> Ed., Oxford University Press, New York, 2005. Theory of Machines, 2 <sup>nd</sup> Ed., Tata McGraw Hill, New , Design of Machinery, Third Edition, Tata McGraw Hill,				Prentice ns, CBS Wiley 6. hines and 2005. I, New raw Hill,	
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	En	viro	nme	ental Studies		Course Code	ES 202
ii	Credit structure	L	Т	Ρ	C (	(Half	semester cours	se)
		2	1	0	3			
iii	Prerequisite, if any(for the students)	Nil						
iv	Course Content							
	Multidisciplinary nature of environmental studies, Ecosystems, Biodiversity and its conservation, Indicators of environmental pollution, Environment and human health							
	Consumption of natural re coal, minerals, energy, policy and legislation, Env	sou anc iror	irce: I la ime	s ar nd), ntal	nd environmer Sustainable impact asses	ntal de dev smer	egradation (for elopment, En nt.	ests, water, vironmental
	Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems, Solid and hazardous waste management (causes, effects and control measures)							
	Air and noise pollution ( Issues including climate depletion, nuclear hazard earthquakes, cyclones and	(science and engineering of pollution control), Global ate change, global warming, acid rain, ozone layer ards, Disaster management (industrial accidents, floods, and landslides),						
V	Texts/References							
	Cunningham W.P. and C Science, Tata McGraw-Hil	unr I Ρι	ning Iblis	han hing	n M.A. (2002 g Company, N	!),  Pri lew D	inciples of En Jelhi.	vironmental
	Nathanson, J.A. (2002), E New Delhi.	Basi	сE	nvir	onmental Tec	hnolo	gy, Prentice H	lall of India,
	Arceivala, S.J. and Asole Control and Reuse, 3rd Ed	kar. ditic	, S.I on, T	R. ( āta	2006), Wast McGraw Pub	ewate lishin	er Treatment f g Co. Ltd., Nev	or Pollution v Delhi.
	Asolekar, S.R. and Go Management – An Indian 2005.	pic Pe	han ersp	idra ecti <sup>r</sup>	n, R. (2005 ve, Foundatio	5), P on Bo	reventive En oks Pvt. Ltd.,	vironmental New Delhi,
	Some selected book-chap	ters	s, m	ono	graphs and jo	ournal	papers	
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

i	Title of the Course	Env	viro	nme	enta	Studies		Course Code	HS 202
ii	Credit structure	L 2	T 1	P 0	C 3	(Half ser	mest	er course)	
:=	Prerequisite, if any(for the students)	Nil							
iv	Course Content								
	Social Issues and the environment, Public awareness and Human rights, Indicators of sustainability, Governance of Natural Resources - Common pool resources: issues and management.								
	Environmental ethics, Re Trends, Environmental Bioregionalism, Environme	eligio mo enta	on a oven Il jua	and nen stice	en Its e.	vironment, and Activ	, Wil vism	derness and , Social Ec	Developing ology and
	Environmental economics regulation, Natural resource	, Tr ce a	ade .cco	an unt	d er ing,	vironment Green GD	i, Ec P.	onomics of en	vironmental
	Environment and develo Impacts of climate change to climate change.	opm e on	ent, ec	, R ono	ese my	ttlement a and societ	and y, Vı	rehabilitation Inerability and	of people, adaptation
V	Texts/References								
	Agar, N., 2001. Life's Intrin	nsic	Val	ue,	Nev	v York: Col	lumb	ia University F	ress.
	Dasgupta, P. and Maler, G Development Issues, Vol.	i. (eo I, O	ds.) UP.	, (19	997)	, The Envi	ronn	nent and Emer	ging
	Guha, Ramachandra (200 <i>Debating on Gandhi</i> , in <i>P</i> Press.	)6): \. R	"Ma lagh	ihat nura	ama Imai	i Gandhi a aju (ed.),	nd E New	nvironmental Delhi: Oxforo	Movement," d University
	Guha, Ramachandra and and Abuse of Nature in Co	Ma onte	idha mpo	av C orar	Gado Y In	gil (1995): dia, New D	Ecol Delhi	logy and Equit Penguin.	ty: The Use
	Hanley, Nick, Jason F. Economics in Theory and	SI Pra	hog ctic	ren e, N	ar Iew	id Ben V Delhi: Mac	Vhite Milla	e (2004): En an.	vironmental
	Naess, A. and G. Ses <i>Ecophilosophy</i> , Vol.6.	sion	IS (	(198	34):	"Basic P	rinci	ples of Deep	b Ecology,"
	Redclift, M. and Woodgate Environmental Sociology,	e, G. Edv	. (eo varc	ds.) I Ed	, (19 Igar.	97), Interi	natio	nal Handbook	of
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

i	Title of the Course	Kinematio Machines	es and Dynamics of Lab.	Course Code	ME 312
ii	Credit structure	LTP	С		
		003	3		
iii	Prerequisite, if any(for the students)	Nil			
iv	Course Content				
	Experiments on velocity, friction; belt drives an vibrations.	static forc d cam-fo	e and acceleration and blower; balancing; be	alysis of me earings; g	echanisms; yroscopes;
v	Texts/References				
	<ol> <li>Uicker J.J., Penno Mechanisms, 3<sup>rd</sup> I</li> </ol>	ock G.R. a Ed., Oxfor	nd Shigley J.E., Theory d University Press, New	of Machine York, 2005	s and
	2. Rattan S.S., Theo 2005.	ry of Macl	nines, 2 <sup>nd</sup> Ed., Tata McG	araw Hill, Ne	ew Delhi,
vi	Instructor(s)name				
vii	Name of other departments to whom the course is relevant				

i	Title of the Course	Heat	Tran	sfer	and	Course Code	MF 314
-		Metr	ology	Lab			
ii	Credit structure	LΤ	Р	С			
		0 0	3	3			
iii	Prerequisite, if any(for the students)	Heat	Tran	sfer,	Manufacturing	g Processes II	
iv	Course Content						
	Part A: Heat Transfer						
	Determination of the therm Determination of the total Study the natural convecti Study the performance of conditions. Heat transfer t Measurement of the force a circular tube. Study the performance of counter flow conditions. Part B: Metrology Measurements of lengths surface finish and errors in	nal co hemis on he a pin hroug d con a dou a dou	nduc spher at tra fin ur h circ vection ble-p les, f	tivity ical e insfe ider cular on he ipe h ipe h	of a material emissivity of a r from a vertic natural and fo tube with unif eat transfer co neat exchange ess, squarene ew threads.	in granular form surface by two al tube. rced convection orm heat flow. efficient in cross er under parallel ss, parallelism,	methods. s-flow over and alignment,
v	Texts/References						
	1. Incropera F. F Transfer, 5th	P. and Ed., V	Dew /iley	itt D. and	P., Fundamer Sons, New Yo	ntals of Heat and rk, 2002.	d Mass
	2. Gayler J. F. W 1990.	I. and	C. R	Sho	tbolt, Metrolog	gy for Engineers	, ELBS,
vi	Instructor(s)name						
vii	Name of other departments to whom the course is relevant						

i	Title of the Course	Machine Desig	n	Course Code	ME 401	
ii	Credit structure	L T P C 2 1 2 8				
iii	Prerequisite, if any(for the students)	Solid Mechanic	S			
iv	Course Content Introduction: design for f manufacture and assemb (ferrous and non-ferrous), permissible stresses; sta material properties in te properties; welds, screw a rolling element bearings lubricants and selection; v of bearing mountings – s fatigue. Introduction to ma Small design exercises - C simple gear box involving profile selection, gear/sha Complete design exercis reciprocating pump, robot	unction, econor y, transport, ma static, dynamic ndard material rms of manufa nd bolted conne , design selec year and assoc ress concentrat chine drawing. totter joints and keyway design, t failure, etc. e on one of t arm with linear	my, stresses, iterials. Physic and impact s a and section acturability Fa- ections. Bearing totion; heat g iated failures. ition and therr rigid/flexible of stress concer he following actuators, etc	operation, mai cal properties of strengths; factor ons and the ma astening technic ngs and friction: generation; prop Shafts, axles a nal expansion. E coupling ; Desig ntration, mountin - hot-air stirling	ntenance, materials of safety; eaning of ques and Bush and berties of nd design Design for n of a g, gear g engine,	
V	<ol> <li>Texts/References</li> <li>Spotts M. F., I</li> <li>Shigley J. E. a Tata McGraw</li> <li>Nieman F. and</li> <li>Hamrock B.J. 1999.</li> <li>Bhatt N. D. ar Publishing Ho</li> <li>Narayana K. I Drawing, New</li> </ol>	esign of Machin nd Mischke C. Hill, 2007. Winter H., Mac Fundamentals d Panchal, V. N Jse, Anand, Ind ., Kannaiah, P. Age Internation	ne Elements, R., Mechanica chine Element of Machine E I., Machine Di ia, 2006. and Venkata aal, Mumbai, 1	Allen and Unwin al Engineering ts, Springer, 1989 lements, McGrav rawing, Charota Reddy K., Machi 999.	, 1968. Design, 9. w Hill, r	
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					
i	Title of the Course	Microprocessors and Automatic Control	Course Code	ME 403		
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ii	Credit structure	L T P C 2 1 0 6				
iii	Prerequisite, if any(for the students)	Nil				
iv	Course Content Introduction, Review of combinational logic circuits. Intro to Sequential circuits, prelim design of sequential circuits, flip-flops. Registers, counters, tri-state logic, Register-register data transfer. Timing and control circuitry. Sequential circuit design examples design considerations for arriving at appropriate data/control paths. Functional architecture of microprocessors, terminology. Intro to Microcontroller Programming. Interfacing – A/D, D/A, Timer. Introduction to feedback, dynamic system behaviour. Math review: Fourier series, transforms, LTI systems, notion of stability. Non-linear system behaviour, linearization. Linear feedback controller design – frequency response based methods. PID control. Sampling theorem, Digital implementation of controllers					
V	<ol> <li>Texts/References</li> <li>Benjamin C. Kuo, Automatic Control Systems, 7th Ed., Prentice Hall, 1995.</li> <li>Randy H. Katz, Contemporary Logic Design, Benjamin/Cummings, 1994.</li> </ol>					
vi	Instructor(s)name					
vii	Name of other departments to whom the course is relevant					

i	Title of the Course	Applied Thermodynamics Lab. Course Code						
ii	Credit structure	LTPC						
		0 0 3 3						
iii	Prerequisite, if any(for the students)	Applied Thermodynamics						
iv	Course Content							
	The following experiments will be conducted.							
	Measurement of characteristics of centrifugal pump and gear pump, Pelton turbine, Francis turbine, vapour compression refrigeration cycle, and triple fluid vapour absorption refrigeration cycle.							
	Performance test / load test of a multi cylinder petrol engine and automotive diesel engine.							
	Measurement of the flame velocity of a pre-mixed mixture and study of flame stability.							
	Measurement of thickness of aluminum foil using technique and level of column of water using nuclear technique.							
v	Texts/References							
	<ol> <li>Cengel Y. A. and Boles M. A., Thermodynamics: An Engineering Approach, McGraw Hill, 3<sup>rd</sup> Ed., 1998</li> </ol>							
vi	Instructor(s)name							
vii	Name of other departments to whom the course is relevant							

					_				
i	Title of the Course	Microprocessor and Automatic Control Lab.				or and Autom	Course Code	ME 413	
ii	Credit structure	L	Т	Ρ	С				
		0	0	3	З				
iii	Prerequisite, if any(for the students)	Nil							
iv	Course Content								
	The course will expose students to electronic prototyping equipment, micro- controllers, power amplifiers, DC and stepper motors and various sensors. Students will perform experiments leading upto the realization of a mechatronic system that works with closed-loop control.								
v	Texts/References								
	<ol> <li>Horowitz P. and Hill W., Art of Electronics, 2nd Ed., Cambridge University Press, 1989.</li> </ol>								
vi	Instructor(s)name								
vii	Name of other departments to whom the course is relevant								

## **INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR**

**FORMAT FOR INTRODUCTION OF NEW COURSE PROPOSAL** (Faculty members willing to introduce new courses shall use this format for making a proposal for consideration of the UGPC / Academic Council)

i	Title of the Course		
ii	Credit structure		
	Core course / Elective (Institute/Departmental)		
iv	Prerequisite, if any(for the students) Existing course No.		
v	Course Content		
vi	Texts / References		
vii	Name of the Instructor/(s)		
	For core course please specify no. of instructors / faculty who can teach the course		
viii	Name of other department (s) to whom the course is relevant		
ix	Justification for introduction of the new course		
x	Statement whether similar course(s) is/ are running in the Institute elsewhere	Course code	

Signature of the course proposer

Signature of the Convener DUGC/DPGC