# B.E AUTOMOBILE ENGINEERING REGULATIONS, CURRICULUM & SYLLABI 2015 (FULL-TIME PROGRAMME)

# Department of Automobile Engineering Faculty of Engineering



**KARPAGAM ACADEMY OF HIGHER EDUCATION** (Deemed to be University Established Under Section 3 of UGC Act 1956)

Eachanari post, COIMBATORE 641 021, INDIA

**B.E. AUTOMOBILE ENGINEERING (REGULAR)** 

#### COURSE OF STUDY AND SCHEME OF EXAMINATIONS

## (2015 and onwards)

SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL	
SEMESTER	I						1		
	TI	IEORY	ľ						
15BECC101	Communicative English –I	3	0	0	3	40	60	100	
15BECC102	Engineering Mathematics I	3	2	0	4	40	60	100	
15BECC103	Engineering Physics	3	0	0	3	40	60	100	
15BECC104	Engineering Chemistry	3	0	0	3	40	60	100	
15BEAE105	Basic Electrical and Electronics	3	0	0	3	40	60	100	
1502/12105	Engineering	5	0	0	5	-10	00	100	
PRACTICALS									
15BECC111	Engineering Physics & Chemistry Laboratory	0	0	3	2	40	60	100	
15BEAE112	Engineering Practice Laboratory	0	0	3	2	40	60	100	
15BEAE113	Engineering Graphics	1	0	4	3	40	60	100	
TOTAL      28 hrs      23      320      480						800			
VALUE ADDED COURSE									
15BECC151	Human Values	1	1	0	1	100	-	100	
SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL	
SEMESTER I	I								
	TH	EORY				, ,			
15BECC201	Communicative English –II	3	0	0	3	40	60	100	
15BECC202	Engineering Mathematics – II	3	2	0	4	40	60	100	
15BECC203	Materials Science	3	0	0	3	40	60	100	
15BECC204	Environmental Studies	3	0	0	3	40	60	100	
15BEAE205	Engineering Mechanics	3	2	0	4	40	60	100	
15BEAE206	Computer Fundamentals and C Programming	3	0	0	3	40	60	100	
L. L	PRAC	TICAI	LS	I		11			
15BEAE211	Computer Practice and Programming Laboratory	0	0	3	2	40	60	100	
15BEAE212	Machine Drawing	1	0	2	2	40	60	100	
	TOTAL		28 hrs		24	320	480	800	
	VALUE AD	DED C	OURSE	5					
15BECC251	Elementary Biology	1	1	0	1	100	-	100	
150100251	Liementary Diology	1	1	U	1	100	-	100	

SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL	
SEMESTER III									
THEORY									
15BEAE301	Methods of Applied Mathematics	3	2	0	4	40	60	100	

15BEAE302	Strength of Materials	3	1	0	4	40	60	100
15BEAE303	Engineering Thermodynamics	3	1	0	4	40	60	100
15BEAE304	Automotive Engines	3	0	0	3	40	60	100
15BEAE305	Two and Three Wheeler Technology	3	0	0	3	40	60	100
	PRAC	TICAL	S					
15BEAE311	Strength of Materials Laboratory	0	0	3	2	40	60	100
15BEAE312	Automotive Engine Components	0	0	3	2	40	60	100
	Laboratory	0	U	5	2	-10	00	100
15BEAE313	Computer Aided Machine Drawing	0	0	3	2	40	60	100
	Laboratory	U	U	5	2	-10	00	100
	Total		28 hrs		24	320	480	800
	VALUE AD	DED CO	DURSE					
15BEAE351	Communication Skills Development	0	0	2	1	100	-	100

SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL
SEMESTER	IV				•	•	•	
	TH	EORY						
15BEAE401	Applied Thermodynamics and Heat Transfer	3	1	0	4	40	60	100
15BEAE402	Automotive Chassis	3	0	0	3	40	60	100
15BEAE403	Automotive Transmission	3	0	0	3	40	60	100
15BEAE404	Kinematics of Machinery	3	0	0	3	40	60	100
15BEAE405	Fluid Mechanics and Machinery	3	0	0	3	40	60	100
15BEAE406	Engineering Materials and Metallurgy	3	0	0	3	40	60	100
	PRAC	TICAL	۵ <b>S</b>					
15BEAE411	Fluid Mechanics and Machinery Lab	0	0	3	2	40	60	100
15BEAE412	Scientific Computing Laboratory	2	0	2	3	40	60	100
15BEAE413	Automotive Chassis & Transmission Laboratory	0	0	3	2	40	60	100
Total      29 Hrs      26      360      540							900	
	VALUE AD	DED C	OURSE	1				
15BEAE451	Soft skills Development	0	0	2	1	100	-	100

SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL	
SEMESTER V									
THEORY									
15BEAE501	Dynamics of Machinery	3	0	0	3	40	60	100	
15BEAE502	Design of Machine Elements	3	0	0	3	40	60	100	
15BEAE503	Automotive Pollution and NVH	3	0	0	3	40	60	100	

	Control								
15BEAE504	Engineering Metrology And	-	0	0		10		100	
	Measurements	3	0	0	3	40	60	100	
15BEAE5E	Department Elective - I	3	0	0	3	40	60	100	
	PRAC	TICAI	LS	l					
15BEAE511	Thermal Engineering Laboratory	0	0	3	2	40	60	100	
15BEAE512	Engineering Metrology and	0	0	2	2	40	(0)	100	
	MeasurementsLaboratory	0	0	3	2	40	60	100	
15BEAE513	DynamicsAnd Mechatronics	0	0	2	2	40	(0)	100	
	Laboratory	0	0	3	2	40	60	100	
	Total		24 Hrs		21	320	480	800	
	VALUE ADI	DED C	OURSE	S					
15BEAE551	In-plant Training	1	1	0	1	100	0	100	
15BEAE552	Technical Presentation & Seminar	1	1	0	1	100	0	100	
			-		-	-	-		
SUB. CODE	TITLE OF THE COURSE	L	Т	Р	С	CIA	ESE	TOTAL	
SEMESTER VI									
	TH	EORY							
15BEAE601	IC Engine design	3	1	0	4	40	60	100	
15BEAE602	Vehicle Dynamics	3	0	0	3	40	60	100	
15BEAE603	Manufacturing Technology	3	0	0	3	40	60	100	
15BEAE604	Engineering Economics and	2	0	0	2	40	60	100	
	Financial Management	3	0	0	3	40	00	100	
15BEAE6E_	Department Elective - II	3	0	0	3	40	60	100	
15BEAE6E_	Department Elective - III	3	0	0	3	40	60	100	
	PRAC	TICAI	LS						
15BEAE611	Automotive Electrical and	0	0	3	2	40	60	100	
	Electronics Laboratory	0	0	3	Δ	40	00	100	
15BEAE612	Manufacturing Processes Laboratory	0	0	3	2	40	60	100	
	Total		25 Hrs		23	320	480	800	
	VALUE AD	DED C	OURSE	1	-	-	-		
15BEAE651	Mini Project	0	0	2	1	100	0	100	
15BEAE652	Value Added Course-I	1	1	0	1	100	0	100	

			r							1
SUB. CODE	TITLE OF THE COURSE	L	Т		Р	C		CIA	ESE	TOTAL
SEMESTER V	VII									
	THE	ORY								
15BEAE701	Finite Element Analysis	3	]	1	0		4	40	60	100
15BEAE702	Automotive Vehicle Design	3	]	1	0		4	40	60	100
15BEAE7E_	Department Elective - IV	3	(	)	0		3	40	60	100
15BEAE7E_	Department Elective - V	3	(	)	0		3	40	60	100
15BEOE_	Open Elective	3	(	)	0		3	40	60	100
	PRACT	ICAI	S							
15BEAE711	Automobile Vehicle Maintenance and Reconditioning Laboratory	0	(	)	3		2	40	60	100
15BEAE712	Auto Scanning and Vehicle Testing Laboratory	0	(	)	3		2	40	60	100
15BEAE713	Computer Aided Design Analysis Laboratory	0	(	)	3		2	40	60	100
	Total		26	Hrs			23	320	480	800
SUB. CODE	TITLE OF THE COURSE	L		Т	P		С	CIA	ESE	TOTAL
	SEMEST	TER V	ΊΠ							
	ТНЕ	ORY								
15BEAE801	Total Quality Management		3	0	)	0	3	40	60	100
15BEAE8E_	Core Elective - VI		3	0	)	0	3	40	60	100
15BEAE8E_	Core Elective - VII		3	0		0	3	40	60	100
	PRACT	TICAI	ĴS							1
15BEAE891	Project Work	(	)	0	2	24	12	120	180	300
	TOTA	L		33 H	lrs		21	240	360	600
	VALUE ADD	ED C	OUI	RSE		r			1	
15BEAE751	Value Added Course –II	1	] ]	1	0		1	100	0	100

Total Credits : 185

Note:

- The credits of value added courses will not be accounted.
- Interested tudents can opt one self studey course in VIII semester from open electives, which will be reflected in the marksheet if he/she passes the course

L: Lecture Hour	T: Tutorial Hour	<b>CIA: Continuous Internal Assessment</b>
P: Practical Hour	C: No. of Credits	ESE: End Semester Examinations

Note: For the following courses, Evaluation will be purely internal. The marks should be handed over to the Office of The Controller of Examinations, along with the Semester Internal marks.

- 1. Communication Skills Development
- 2. Soft Skills Development
- 3. Technical Presentation and Seminar
- 4. All Value Added Courses

### **B.E. AUTOMOBILE ENGINEERING**

#### LIST OF ELECTIVES

	Electives (For	r V Se	mester	)				
Sub. Code	Title Of The Course	L	Т	Р	С	CIA	ESE	Total
15BEAE5E1	Composite Materials	3	0	0	3	40	60	100
15BEAE5E2	Special Vehicles	3	0	0	3	40	60	100
15BEAE5E3	Tractor and Farm Equipments	3	0	0	3	40	60	100
15BEAE5E4	Off Road Vehicles	3	0	0	3	40	60	100
15BEAE5E5	Vehicle Maintenance	3	0	0	3	40	60	100
	Electives (For	· VI S	emester	r)	l .	•		
15BEAE6E1	Design for Manufacture and Assembly	3	0	0	3	40	60	100
15BEAE6E2	Optimization for Engineering Design	3	0	0	3	40	60	100
15BEAE6E3	Automotive Aerodynamics	3	0	0	3	40	60	100
15BEAE6E4	Computational Fluid Dynamics	3	0	0	3	40	60	100
15BEAE6E5	Vibration and Noise Control	3	0	0	3	40	60	100
15BEAE6E6	Failure Analysis and Design	3	0	0	3	40	60	100
15BEAE6E7	Computer Aided Vehicle Design	3	0	0	3	40	60	100
15BEAE6E8	Principles of Management and Entrepreneurship	3	0	0	3	40	60	100
	Electives (For	VII S	emeste	r)				
15BEAE7E1	Automotive Electrical and Electronics Systems	3	0	0	3	40	60	100
15BEAE7E2	Intelligent Vehicle Technology	3	0	0	3	40	60	100
15BEAE7E3	Modern Vehicle Technology	3	0	0	3	40	60	100
15BEAE7E4	Automation and Mechatronics	3	0	0	3	40	60	100
15BEAE7E5	Lean Manufacturing	3	0	0	3	40	60	100
15BEAE7E6	Supply Chain Management	3	0	0	3	40	60	100
15BEAE7E7	Process Planning and Cost Estimation	3	0	0	3	40	60	100
15BEAE7E8	Professional Ethics	3	0	0	3	40	60	100
15BEAE7E9	Production Process for Automotive Components	3	0	0	3	40	60	100
	Electives (For	VIIIS	Semeste	er)				
15BEAE8E1	Automotive Air Conditioning	3	0	0	3	40	60	100
15BEAE8E2	Alternate Fuels and Energy systems	3	0	0	3	40	60	100
15BEAE8E3	Advanced Theory of IC Engines	3	0	0	3	40	60	100
15BEAE8E4	Fuel Cell Technology	3	0	0	3	40	60	100
15BEAE8E5	Quality Control and Reliability Engineering	3	0	0	3	40	60	100
15BEAE8E6	Intellectual Property Rights (IPR)	3	0	0	3	40	60	100
15BEAE8E7	Vehicle Transport Management	3	0	0	3	40	60	100
15BEAE8E8	Vehicle Body Engineering and Safety	3	0	0	3	40	60	100
15BEAE8E9	Industrial Engineering and Operations Research	3	0	0	3	40	60	100

VALUE ADDED COURSES									
Sub. Code	Title Of The Course	L	Т	Р	С	CIA	ESE	Total	
15BEAE65_	Industrial Robotics	1	1	0	1	100	0	100	
15BEAE65_	Computer Hardware and Interfacing	1	1	0	1	100	0	100	
15BEAE75_	Fuels and Lubricants	1	1	0	1	100	0	100	
15BEAE75_	Automotive Ergonomics and Safety	1	1	0	1	100	0	100	

#### LIST OF OPEN ELECTIVES

	<b>OPEN ELECTIVE ( Courses</b>	offere	ed by of	ther De	partment	t)		
	BIOTECH	INOL	OGY					
15BTBTOE01	Bioreactor Design	3	0	0	3	40	60	100
15BTBTOE02	Food Processing and Preservation	3	0	0	3	40	60	100
15BTBTOE03	Molecular Modeling	3	0	0	3	40	60	100
15BTBTOE04	Bioremediation	3	0	0	3	40	60	100
15BTBTOE05	Biophysics	3	0	0	3	40	60	100
15BTBTOE06	Basic Bioinformatics	3	0	0	3	40	60	100
15BTBTOE07	Fundamentals of Nano	2	0	0	2	40	60	100
	Biotechnology	3	0	0	5	40	00	100
	CIVIL ENG	INEE	RING		-		_	
15BECEOE01	Housing, Plan and Management	3	0	0	3	40	60	100
15BECEOE02	Building Services	3	0	0	3	40	60	100
15BECEOE03	Coastal Zone Management	3	0	0	3	40	60	100
15BECEOE04	Experimental Method and Model	3	0	0	3	40	60	100
	Analysis	5	0	0	5	40	00	100
15BECEOE05	Management of Irrigation Systems	3	0	0	3	40	60	100
15BECEOE06	Computer Aided Design of	3	0	0	3	40	60	100
	Structure	5	0	0	5	40	00	100
15BECEOE07	Pavement Engineering	3	0	0	3	40	60	100
15BECEOE08	Rock Engineering	3	0	0	3	40	60	100
15BECEOE09	Storage Structures	3	0	0	3	40	60	100
15BECEOE10	Wind Engineering	3	0	0	3	40	60	100
15BECEOE11	Advanced Construction	3	0	0	3	40	60	100
	Technology	5	0	0	5	40	00	100
	COMPUTER SCIEN	ICE E	NGINI	EERIN	G			
15BECSOE01	Python Programming	3	0	0	3	40	60	100
15BECSOE02	Internet Programming	3	0	0	3	40	60	100
15BECSOE03	Multimedia and Animation	3	0	0	3	40	60	100
15BECSOE04	PC Hardware and Trouble shooting	3	0	0	3	40	60	100
15BECSOE05	Game Programming	3	0	0	3	40	60	100
	ELECTRICAL AND ELEC	TRO	NICS E	NGINI	EERING			
15BEEEOE01	Electric Hybrid Vehicles	3	0	0	3	40	60	100

15BEEEOE02	Energy Management & Energy	3	0	0	3	40	60	100
15BEEEOE03	Sensors & Transducers	3	0	0	3	40	60	100
15BEEEOE03	Programmable Logic Controller	3	0	0	3	40	60	100
15BEEE0E05	Renewable Energy Resources	3	0	0	3	40	60	100
15BEEEOE06	Advanced Control Systems	3	0	0	3	40	60	100
15DLLLOL00	FLECTRONICS AND COMM			N ENG	INEERIN		00	100
15BEECOE01	Real Time Embedded Systems	3	0	0	3	40	60	100
15BEECOE02	Consumer Electronics	3	0	0	3	40	60	100
15BEECOE03	Fundamentals of Nanotechnology	3	0	0	3	40	60	100
15BEECOE04	Image &Video Processing	3	0	0	3	40	60	100
15BEECOE05	VLSI Technology	3	0	0	3	40	60	100
15BEECOE06	Fundamentals of MEMS	3	0	0	3	40	60	100
15BEECOE07	Neural Networks and its	2	0	0	2	40	(0)	100
	Applications	3	0	0	3	40	60	100
15BEECOE08	Fuzzy Logic and its Applications	3	0	0	3	40	60	100
	MECHANICAL	ENG	INEER	ING				
15BEMEOE01	Introduction to MEMS	3	0	0	3	40	60	100
15BEMEOE02	Robotics	3	0	0	3	40	60	100
15BEMEOE03	Industrial Safety and Environment	3	0	0	3	40	60	100
15BEMEOE04	Transport Phenomena	3	0	0	3	40	60	100
15BEMEOE05	Introduction to Biomechanics	3	0	0	3	40	60	100
	SCIENCE AND	HUM	IANIT	IES				
15BESHOE01	Industrial Mathematics I	3	0	0	3	40	60	100
15BESHOE02	Industrial Mathematics II	3	0	0	3	40	60	100
15BESHOE03	Probability and Random Process	3	0	0	3	40	60	100
15BESHOE04	Probability and Statistical Methods	3	0	0	3	40	60	100
15BESHOE05	Probability and Queuing Theory	3	0	0	3	40	60	100
15BESHOE06	Fuzzy Mathematics	3	0	0	3	40	60	100
15BESHOE07	Mathematical Physics	3	0	0	3	40	60	100
15BESHOE08	Advanced Engineering	3	0	0	3	40	60	100
	Mathematics	5	0	Ŭ	5	10	00	100
15BESHOE09	Linear Algebra	3	0	0	3	40	60	100
15BESHOE10	Transorms and Partial Differential		0	0	2	10	60	100
	Equations (only for B.E. CSE	3	0	0	3	40	60	100
	students)	2	0	0	2	40	(0)	100
15BESHOEI1	Coophysics	3	0	0	3	40	60	100
15BESHOE12	Geophysics	2	0	0	3	40	60	100
15BESHOE13	Alternata Evals and Energy	3	0	0	3	40	00	100
IJDESHUE14	Systems	3	0	0	3	40	60	100
15PESUOE15	Solid Waste Management	2	0	0	2	40	60	100
15BESHOE16	Green Chemistry	3	0	0	3	40	60	100
15BESHOE17	Applied Electrochemistry	3	0	0	3	40	60	100
15BESHOE18	Industrial Chemistry	3	0	0	3	40	60	100
15DESHOE10			U Se offor	od to of	hor Dong	rtmont)	00	100
15BEAFOF01	Automobile Engineering	3			3	40	60	100
15BEAEOE02	Basics of Two and Three Wheelers	3	0	0	3	40	60	100
15BEAEOE02	Automobile Maintenance	3	0	0	3	40	60	100
1JDLALOL0J		5	U	U	5	+0	00	100

15BEAEOE04	Introduction to Modern Vehicle Technology	3	0	0	3	40	60	100
------------	--	---	---	---	---	----	----	-----

#### 15BECC101 COMMUNICATIVE ENGLISH – I 3003100

#### **Course Objectives :**

- To enable students to attain fluency and accuracy to inculcate proficiency in professional communication to meet the growing demand in the field of Global communication.
- To help students acquire their ability to speak effectively in real lifesituations.
- To inculcate the habit of reading and to develop their effective readingskills.
- To ensure that students use dictionary to improve their active and passivevocabulary.
- To enable students to improve their lexical, grammatical and communicative competence.
- To study formal context

#### **Course Outcomes**

Students undergoing this course will be able to

- 1 Use English language for communication: verbal & non –verbal.
- 2 Enrich comprehension and acquisition of speaking & writing ability.
- 3 Gain confidence in using English language in real life situations.
- 4 Improve word power: lexical, grammatical and communication competence.
- 5 To guide the students to write business letters and other forms of technical writing.
- 6 To remember students to prepare for oral communication in formal contexts.

#### Unit I

(9)

**Listening**– Types of listening - Listening to class reading - Video tapes/ Audio tapes. **Speaking** – Introduction on self - Introduction on one's friend. **Reading** - Reading for comprehension – Reading different kind of passages like descriptive, narrative, objective, conversational and argumentative. **Writing** – Free writing on any topic –My favorite place, hobbies, dreams, goals, etc- Writing short messages - To fill in different application forms. **Grammar** – Articles- WH questions –Yes/No Question - Subject Verb agreement. **Vocabulary** - Word Formation – Word expansion (Root word) - Prefix and Suffix.

#### Unit II

**Listening** – Understanding the passage in English –Pronunciation practice. **Speaking** – Asking and answering questions - Telephone etiquette. **Reading** – Critical reading – Finding key information in a given text (Skimming - Scanning). **Writing** – Coherence and cohesion in writing – Short paragraph writing – Letters to the Editor. **Grammar**– Parts of speech – Noun – Verb – Adjectives - Adverbs. **Vocabulary**– Compound Nouns/Adjectives – Irregular verbs.

#### Unit III

Listening – Listening for specific task – Fill in the gaps. Speaking – Phonemes – Syllables – Role play – Conversation Practice. Reading – Reading and Comprehension. Writing - Autobiographical writing –

#### (10)

#### (10)

#### ...

(10)

Biographical writing - Instruction writing. Grammar - Preposition - Infinitive - Gerund - Tenses. **Vocabulary** – Foreign words used in English – British and American usage.

#### Unit IV

Listening – Responding to questions – Reading in class for complete understanding and for better pronunciation. Speaking – Debate- Presentations in seminars. Reading – Making inference from the reading passage – Predicting the content of reading passages. Writing - Interpreting visual materials (tables, graphs, charts, etc) – Formal and Informal letters. Grammar – Sentence pattern – Voice (active and passive voice). Vocabulary – One word substitution.

#### Unit V

**TEXT BOOK:** 

Listening - Listening to different accents, speeches/presentations. Speaking- Extempore talk -Just-a-minute talk. **Reading**-Reading strategies–Intensive reading – Text analysis. Writing - Creative writing – Writing circulars and notices - Writing proposal. Grammar - Direct and Indirect speech - Conditional sentences -Auxiliary verbs. **Vocabulary** – Abbreviations & Acronyms.

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

#### Total: 45

									-				REF
5	5. NO.	AUTHOR(S)	TITLE	E OF THE	E BOOK	P	UBLISHER		YE	EAR	OF	E	REN
		NAME							PU	<b>BLICA</b>	ΓΙΟΝ		ES:
]	-	Sangeeta	Techni	cal		0	UP,		20	15			
	S. NO.	SlaathTHOR(S)	Comm	ui <b>TiETiE</b> dea:	OF TH	EN	e <b>RUBIHSHI</b>	ER		YEAR		DF	
		MN en MKE hi	Princip	1 <b>BOQK</b> I	Practice					PUBLI	CATIO	DN	
	1	Rhankashminaraya	n2amd Ed	i <b>Com</b> mur	nication		SCITECH	Publicatio	ns,	2009			
		K.R. & Mur	ugavel,	Skills for	r Engineer	S	Chennai						
		Т.											
	2	Rizvi Ashraf, N	N	Effective	e Technic	al	Tata McGra	ıw-Hill,		2007			
				Commun	nication		New Delhi.						
	3	Rutherford And	drea, J.	Basic			Pearson Ed	ucation, N	ew	2006			
				Commun	nication		Delhi.						
				Skills	f	or							
				Technolo	ogy								

#### WEBSITES:

www.learnerstv.com – Listening/ Speaking/ Presentation
www.usingenglish.com – Writing/ Grammar
www.englishclub.com – Vocabulary Enrichment/ Speaking
www.ispeakyouspeak.blogspot.com - Vocabulary Enrichment/ Speaking
www.teachertube.com – Writing Technically
www.Dictionary.com – Semantic / Grammar

#### (8)

(8)

#### ENGINEERING MATHEMATICS I 3204100

#### **15BECC102 Course Objectives:**

- To understand geometrical aspects of curvature and elegant application of differential ٠ calculus and improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives and vector calculus.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations and partial differential equations.
- To introduce sequence and series which is central to many applications in engineering. •
- To study the algebraic manipulation

#### **Course Outcomes:**

The student will be able to

- The student will be able to Apply advanced matrix knowledge to Engineeringproblems. •
- Improve their ability in solving geometrical applications of differentialcalculus Problems.
- Solve engineering problems involving hyperbolic functions, Beta • andGamma functions.
- Expose the concept of sequences andseries.
- To analyze and evaluate the accuracy of solution for ordinary differential equations
- To understand the difference of beta and gamma functions in control engineering

#### UNIT I MATRICES

Review of Matrix Algebra - Characteristic equation - Eigenvalues and Eigenvectors of a real matrix -Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonal reduction.

#### **UNIT II DIFFERENTIAL CALCULUS**

Overview of Derivatives - Curvature in Cartesian co-ordinates - Centre and radius of curvature - Circle of curvature - Evolutes - Envelopes- Evolutes as Envelope of normals - Maxima and Minima of functions of two or more Variables - Method of Lagrangian Multipliers

#### **UNIT III SEQUENCES AND SERIES**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparision test, Integral test and D'Alembert's ratio test - Alternating series - Leibnitz's test - Series of positive and negative terms - Absolute and conditional convergence.

#### UNIT IV HYPERBOLIC FUNCTIONS, BETA AND GAMMA FUNCTIONS (12)

Hyperbolic functions: Hyperbolic functions and Inverse Hyperbolic functions - Identities - Real and imaginary parts - solving problems using hyperbolic functions.

#### (12)

# (13)

(12)

**Beta And Gamma Functions :** Definitions – Properties – Relation between beta and gamma integrals – Evaluation of definite integrals in terms of beta and gamma functions.

#### UNIT V DIFFERENTIAL EQUATIONS

### (11)

•••

Linear Differential equations of second and higher order with constant coefficients - Euler's form of Differential equations – Method of variation parameters.

#### Total : 60 TEXT BOOKS:

S.	Author(s) Name	Title of the book	Publisher	Year of
No.				Publication
1	Hemamalini. P.T	Engineering	McGraw Hill Education	2014
		Mathematics	(India) Private Limited,	
			New Delhi.	
2	Sundaram, V.	Engineering	Vikas Publishing Home,	2006
	Lakhminarayan,K.A.	Mathematics	New Delhi.	
	& Balasubramanian,R.	for first year.		

#### **REFERENCES**:

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Grewel . B. S.	Higher Engineering Mathematics	Khanna Publications, New Delhi.	2014
2	Bhaskar Rao. P. B, Sri Ramachary SKVS, Bhujanga Rao. M	Engineering Mathematics I	BS Publications, India.	2010
3	Ramana. B.V	Higher Engineering Mathematics	TataMcGrawHillPublishingCompany,NewDelhi.	2007
4	Shahnaz Bathul	TextbookofEngineeringMathematics(SpecialFunctionsandComplex Variables)	PHI Publications, New Delhi.	2009
5	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

#### WEBSITES :

- 1. www.efunda.com
- 2. www.mathcentre.ac.uk
- 3. www.intmath.com/matrices-determinants
- 4. www. Intmath.com/calculus/calculus-intro.php

97

#### Course Objectives:

**15BECC103** 

- To inculcate the basics of properties of matter and its applications.
- To study the basics of sound and ultrasonics with appropriate applications.
- To study the fundamentals of thermal and quantum physics and their applications.
- To introduce the concepts of light, laser and fibre optics for diverse applications.
- To impart the basic knowledge of crystal and its various crystal structures.
- To study the quantum mechanics.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Describe the basics of properties of matter and its applications.
- Express the concepts of sound, ultrasonic and their applications.
- Illustrate the thermal properties of materials and advanced physics concepts of quantum theory.
- Identify the basics of light, laser and their applications.
- Identify the basics of fibre optics and their applications.
- Explain the basics of crystals and their structures.

#### UNIT I PROPERTIES OF MATTER AND THERMODYNAMICS

Three types of modulus of elasticity – basic definitions, relation connecting the modulii (Derivation), poison ratio- Torsional pendulum- bending of beams- bending moment – basic assumption of moment – uniform and non uniform bending.

Concept of entropy- change of entropy in reversible and irreversible processes – refrigeration.

#### UNIT II LASER AND FIBER OPTICS

Introduction – emission and absorption process- Einstein's coefficients derivation. Types of LASER -CO<sub>2</sub>, Semiconductor LASER- Applications of LASER in industry and medicine.

Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle –derivations, types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram)

#### UNIT III QUANTUM PHYSICS (9)

Introduction to quantum theory – Compton effect- dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – physical significance of wave function, Schrödinger's wave equation – time dependent and time independent equations – particle in one dimensional box- scanning electron microscope.

#### UNIT IV CRYSTAL PHYSICS (9)

Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures- crystal defects – point, line and surface defects

#### UNIT V ULTRASONICS AND NUCLEAR PHYSICS (9)

(9)

(9)

Production of ultrasonics by piezoelectric method –Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications - Sonogram Introduction – basics about nuclear fission and fusion, nuclear composition –Radiation detectors – semi conductor detector. Reactors – essentials of nuclear reactor- power reactor.

#### Total: 45

#### **TEXT BOOK:**

S.No	Author(s) Name	Title of the book	Publisher		Year	of
					Public	cation
1	Ganesan.S and	Engineering Physics I	GEMS	Publisher,	$2^{nd}$	Edition-
	Baskar.T		Coimbatore-641 001		2015	
	Baskar.T		Coimbator	e-641 001	2015	

#### **REFERENCES:**

S.No	Author(s) Name	Title of the book	Publisher	Year of
				Publication
1	Serway and Jewett	Physics for Scientists	Thomson	8 <sup>th</sup> Edition
		and Engineers with	Brooks/Cole, Indian	2010
		Modern Physics	reprint, New Delhi	
2	Gaur, R.K. and	<b>Engineering Physics</b>	Dhanpat Rai	9 <sup>th</sup> Edition
	Gupta, S.C		Publications,New	2011
			Delhi.	

#### WEBSITES:

- 1. www.nptel.ac.in
- 2. www.physicsclassroom.com
- 3. www. oyc.yale.edu
- 4. www.physics.org

#### 15BECC104

#### **Course Objectives:**

- To understand the terminologies of atomic and molecular structure.
- To study the basics of periodic properties and intermolecular forces.
- To study about spectroscopic technique.
- To understand the thermodynamic functions.
- To comprehend the basic Surface Chemistry.
- To get the knowledge of fuels and combustion

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Analyse microscopic chemistry in terms of atomic and molecular orbital and intermolecular forces.
- Rationalise periodic properties such as ionization potential, oxidation states and electronegativity.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise bulk properties and processes using thermodynamic considerations.
- List major chemical reactions that are used in the synthesis of molecules.
- Integrate the chemical principles in the projects undertaken in the field of engineering and technology.

(9)

#### UNIT I WATER TECHNOLOGY

Characteristics – Alkalinity – Types of alkalinity and determination – Hardness – Types and estimation by EDTA method (problems) - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

#### UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES

Electrochemical cells – Reversible and irreversible cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Potentiometric titrations (Redox -  $Fe^{2+}vs$  dichromate) –Batteries- Primary batteries-Leclanche cell-Secondary batteries- Lead acid battery.

#### UNIT III FUELS AND ROCKET PROPELLANTS

Coal - Proximate and Ultimate analysis - Metallurgical coke - Manufacture by Otto-Hoffman method -Petroleum processing and fractions - Synthetic petrol - Bergius and Fischer-Tropsch method - Knocking -Octane number and Cetane number - Gaseous fuels - Water gas, Producer gas, An introduction to Fuel Cell, H<sub>2</sub>-O<sub>2</sub> Fuel Cell -Rocket engines-Types of rocket engines, Basic principles, Mass fraction.

#### UNIT IV CORROSION SCIENCE

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective

(9)

### (9)

(9)

#### UNIT V SURFACE CHEMISTRY

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm-Industrial adsorbent materials- Role of adsorbents in catalysis and water softening-Emulsion-Types-water/oil, oil/water-Applications of adsorption.

#### Total: 45

(9)

<b>S</b> .	Author(s) Name	Title of the book	Publisher	Year of
No.				Publication
1.	Dr. Vairam.S	Engineering Chemistry	Gems Publishers,	2014
			Coimbatore.	
2.	Dr.Ravikrishnan.A	Engineering Chemistry I &	Sri Krishna Hi tech	2012
		II	Publishing Company (P)	
			Ltd., Chennai.	

#### **REFERENCE BOOKS:**

**TEXT BOOKS:** 

S.	Author(s) Name	Title of the book	Publisher	Year of
No.				Publication
1.	Raman	Engineering Chemistry I &II	McGraw-Hill Publishing	2013
	Sivakumar		Co.Ltd., 3 <sup>rd</sup> Reprint	
			NewDelhi.	
2.	Kuriakose. J.C.	Chemistry in Engineering	Tata McGraw Hill	2010
	and Rajaram	and Technology. Vol. I & II	Publishing Company, New	
		5 <sup>th</sup> edition.	Delhi.	
3.	Jain, P.C. and	Engineering Chemistry.	Dhanpat Rai	2009
	Monika Jain		Publishing Company (P)	
			Ltd., New Delhi.	
4.	Dara.S.S	Text book of Engineering	S.Chand & Co.Ltd., New	2008
		Chemistry.	Delhi	
5.	Sharma.B. K	Engineering Chemistry	Krishna Prakasam Media	2001
			(P) Ltd., Meerut	

#### **WEBSITES:**

- http://www.studynotes.ie/leaving-cert/chemistry/
- http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html
- http://www.learnerstv.com/Free-chemistrv-Video-lectures-ltv044-Page1.htm

#### **Course Objectives**

- 1. ToimpartthebasicknowledgeabouttheElectriccircuits.
- 2. To understand the working of various Electrical Machines.
- 3. To understand the concepts of AC and DC currents.
- 4. To know about various measuringinstruments.
- 5. Tounderstandthebasicconceptsinsemiconductordevices.
- 6. Tounderstandthebasicconcepts of digitalelectronics

#### Course Outcomes

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

- Understand thebasicknowledgeabouttheElectriccircuits. •
- Infer the characteristics of various Electrical Machines.
- Extend the knowledge on concepts of AC and DC currents.
- Understand the various measuringinstruments.
- Develop the idea of semiconductordevices.
- Understand thebasicknowledgeaboutdigitalelectronics

#### UNIT I ELECTRIC CIRCUITS

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase balanced Circuits.

#### **UNIT II ELECTRICAL MACHINES**

#### Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, Single Phase Induction Motor.

#### **UNIT III MEASURING INSTRUMENTS**

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

#### UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS

Characteristics of PN Junction Diode - Zener Effect - Zener Diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation, Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics.

#### **UNIT V DIGITAL ELECTRONICS**

Binary Number System - Logic Gates - Boolean Algebra - Half and Full Adders - Flip-Flops - Registers and Counters – A/D and D/A Conversion (single concepts)

#### **Total Hours:45**

#### **TEXT BOOKS**

S.NO	Author(s) Name	Title of the book	Publisher	Year of publication
1	Mittle, V.M	Basic Electrical Engineering	Tata McGraw Hill Edition, New Delhi	2004
2	Sedha R.S	Applied Electronics	S. Chand & Co	2006

#### 9

9

# 9

9

9

#### **REFERENCE BOOKS**

S.NO	Author(s) Name	Title of the book	Publisher	Year of publication
1	Muthusubramanian R, Salivahanan S and Muraleedharan K A	Basic Electrical, Electronics and Computer Engineering	Tata McGraw Hill, Second Edition	2006
2	Nagsarkar T K and Sukhija M S	Basics of Electrical Engineering	Oxford press	2005
3	Premkumar N	Basic Electrical Engineering	Anuradha Publishers	2003
4	Mahmood Nahvi and Joseph A. Edminister	Electric Circuits	Schaum' Outline Series, McGraw Hill	2002

#### 15BECC111 ENGINEERING PHYSICS AND CHEMISTRY LABORATORY 0032100

#### **ENGINEERING PHYSICS**

#### **Course Objectives**

- To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
- To study the concept of semiconductor and conductivity.
- To learn the properties of materials.
- To learn the device for determine the wavelength and velocity of sound
- To study the viscosity of liquids
- To learn the bandgap of semiconductor **Course Outcome**
- Familiarize the properties of material and basic concepts in physics.
- Get experience in laser wavelngth experimenattion
- Get practical exposure to analyse the velocity of sound
- Get knowledge in bandgap and wavelengh determination
- Acquire knowledge about different bendings
- Practical knowledge in therml conductivity of wire and its thickness

#### LIST OF EXPERIMENTS – PHYSICS

- 1. Determination of velocity of sound and compressibility of liquid Ultrasonic interferometer.
- 2. Determination of wavelength of mercury spectrum spectrometer grating.
- 3. Determination of Young's modulus of the material Non uniform bending or Uniform bending.
- 4. Determination of Viscosity of liquid Poiseuille's method.
- 5. Spectrometer Dispersive power of a prism.
- 6. Torsional pendulum Determination of Rigidity modulus.
- 7. Particle size determination using Diode Laser
- 8. Determination of Laser parameters Wavelength, and angle of divergence.
- 9. Determination of acceptance angle in an optical fiber.
- 10. Determination of thickness of a thin wire Air wedge method
- 11. Determination of Band Gap of a semiconductor material.
- 12. Determination of Specific resistance of a given coil of wire Carey Foster Bridge

#### **ENGINEERING CHEMISTRY**

#### **Course Objectives**

- To learn the basic concepts in chemical terms relevant to different branches of Engineering and Technology.
- To study the concept of alkalinity of water sample.
- To study the hardness and chloride in water by experimental methods
- To learn the ferric ion by spectrophotometry
- To study the PH Titration
- To study the molecular weight and degree of polymerization using viscometry

#### **Course Outcome**

- 1. Familiarize the properties of material and basic concepts in chemistry
- 2.Get experience in argentometric method experimentation
- 3.Get practical exposure to analyse the water sample
- 4.Get knowledge in spectrophotometry
- 5. Acquire knowledge about different crystal formation in water
- 6.Practical knowledge in determine the chemical oxygen demand

#### LIST OF EXPERIMENTS - CHEMISTRY

- 1. Estimation of alkalinity of Water sample
- 2. Estimation of hardness of Water by EDTA
- 3. Estimation of chloride in Water sample (Argentometric method)
- 4. Determination of corrosion rate by weight loss method.
- 5. Conductometric Titration (Simple acid base).
- 6. Conductometric Titration (Mixture of weak and strong acids).
- 7. Conduct metric Titration using BaCl<sub>2</sub> vs Na<sub>2</sub> SO<sub>4</sub>.
- 8. pH Titration (acid & base).
- 9. Potentiometric Titration (Fe<sup>2+</sup> / KMnO<sub>4</sub> or  $K_2Cr_2O_7$ ).
- 10. Estimation of Ferric iron by Spectrophotometry.
- 11. Determination of water of crystallization of a crystalline salt (Copper sulphate).
- 12. Determination of molecular weight and degree of polymerization using Viscometry.
- 13. Determination of chemical oxygen demand.

#### 15BEAE112

#### Course Objectives:

- To provide hands-on training for the fabrication of components using carpentry and welding equipment/tools.
- To gain the skills for making fitting joints and household pipeline connections using suitable tools.
- To develop the skills for preparing the green sand mould.
- To present the skills for making the simple household electrical connection.
- To develop the skills for making wood/metal models using suitable tools.

#### Course Outcomes:

- Fabricate simple components using carpentry and welding equipment/tools.
- Make fitting joints and household pipeline connections using suitable tools.
- Prepare green sand mould using suitable tools.
- Make simple household electrical connections using suitable tools.
- Make simple models using wood and metal.
- Make simple plumbing work

#### PART – A (CIVIL & MECHANICAL)

#### 1. WELDING

i. Preparation of arc welding of butt joints, lap joints and tee joints.

#### 2. BASIC MACHINING

- i. Simple Turning and Taper turning
- ii. Drilling and Tapping

#### 3. SHEET METAL WORK

i. Model making – Trays, funnels, etc.

#### 4. DEMONSTRATION ON

- i. Smithy operations
- ii. Foundry operations
- iii. Plumbing Works
- iv. Carpentary Works

#### PART -B (ELECTRICAL & ELECTRONICS)

#### 5. ELECTRICAL ENGINEERING

- i. Study of electrical symbols and electrical equipments.
- ii. Construct the wiring diagram for Stair case wiring and Fluorescent lamp wiring.
- iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- iv. Measurement of electrical quantities voltage, current, power & power factor in R load.
- v. Measurement of energy using single phase energy meter.

#### 6. ELECTRONICS ENGINEERING

- i. Study of Electronic components- Resistor (color coding), capacitors and inductors.
- ii. Soldering practice Components Devices and Circuits Using general purpose PCB.
- iii. Study of logic gates AND, OR, NOT, NOR and NAND.
- iv. Study of HWR and FWR.

#### REFERENCES

- 1. Jeyachandran, K., Natarajan, S. and Balasubramanian, S, "A Premier on Engineering Practices Laboratory", Anuradha Publications, Kumbakonam, 2007.
- 2. Jeyapoovan, T., Saravanapandian, M, "Engineering Practices Lab Manual", Vikas Puplishing House Pvt. Ltd, Chennai, 2006.
- 3. Bawa, H.S, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, New Delhi, 2007.

#### 15BEAE113

#### **ENGINEERING GRAPHICS**

#### **Course Objectives:**

- To learn conventions and use of drawing tools in making engineering drawings.
- To impart knowledge on orthographic projection.
- To draw orthographic projections of points, line and plane surfaces.
- To draw orthographic projections of solids.
- To impart the basic concepts of isometric projections through simple examples.
- To impart knowledge of the CAD software

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Recognise the conventions and apply dimensioning concepts while drafting simple objects.
- Draw freehand sketching of multiple views from pictorial views of objects.
- Draw the orthographic projection of points, line and plane surfaces.
- Draw the orthographic projection of solids.
- Draw the isometric projection of the given objects.
- Demonstrate knowledge of the CAD software

#### UNIT I INTRODUCTION

Introduction to Engineering Drawing, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

#### UNIT II SCALES AND PLANE CURVES

SCALES:Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics – Construction of Ellipse, Parabola and Hyperbola by eccentricity method

#### UNIT III FREE HAND SKETCHING

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

#### UNIT IV PROJECTION OF POINTS, LINES AND PLANE SURFACES

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Traces–Projection of polygonal surface and circular lamina inclined to both reference planes.

### UNIT V PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

#### Introduction to Drafting Software/Package (Not for Exam):

Basic operation of drafting packages, use of various commands for drawing, dimensioning, editing, modifying, saving and printing/plotting the drawings. Introduction to 3D primitives.

#### **TEXT BOOKS**

- 1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New Age International Publishers, 2007.
- 2. VTU, "A Primer on Computer Aided Engineering Drawing" Belgaum, 2006.

#### REFERENCES

- 1. Kumar M S, "Engineering Graphics", D D Publications, Chennai, Ninth Edition, 2007.
- 2. Bureau of Indian Standards, "Engineering Drawing Practices for Schools and Colleges SP 46-2003", BIS, New Delhi, 2003.

3. Luzadder W J, "Fundamentals of Engineering Drawing", Prentice Hall Book Co., New York, 1998. **WEB REFERENCES** 

- 1. IS 10711 2001: Technical products Documentation Size and lay out of drawing sheets.
- 2. IS 9609 (Parts 0 and 1) 2001: Technical products Documentation Lettering.
- 3. IS 10714 (Part 20) 2001 and SP 46 2003: Lines for technical drawings.
- 4. IS 11669 1986 and SP 46 2003: Dimensioning of Technical Drawings.
- 5. IS 15021 (Parts 1 to 4) 2001: Technical drawings Projection Methods.

#### 15BECC151

#### **HUMAN VALUES**

#### **INTENDED OUTCOME:**

• Educate the values and meaning of life in the young minds and to transform them as responsible citizens

#### UNIT – I :(4)

Human life on Earth - Concept of Human Values - Value Education - Aim of education and value education

- Types of values - Components of values - Attitudes - types of attitudes

#### UNIT – II :

Self Development : Self analysis – Goal Setting - Thought Analysis – Guarding against Anger - Respect to age, experience, maturity, family members, neighbors, co-workers

#### UNIT – III :

(5)

(4)

Individual Qualities – Truthfulness – Constructivity – Sacrifice – Sincerity - Self Control – Altruism – Tolerance - Scientific Vision – Regulating Desire **UNIT – IV:(4)** 

Mind Culture - Modern Challenges of Adolescent - Emotions and behavior - Sex and spirituality - Adolescent Emotions - Meditation

#### UNIT - V :(3)

Body and Mind Fitness : (a) Physical Exercises (b) Activities: (i) Moralization of Desires (ii) Neutralization of Anger (iii) Eradication of Worries (iv) Benefits of Blessings .

#### Total: 20

EFEREN	CE BOOKS:			
S.No	Author(s) Name	Title of the book	Publisher	Year of Publications
1	Subramanian. R	<b>Professional Ethics</b>	Oxford, New Delhi	2013
2	Govindarajan. M, Natarajan. S, Senthil Kumar. V.S	Engineering Ethics	Prentice Hall of India, New Delhi	2004
3	Tripathi. A.N	Human Values	New Age International	2009
4	Pope. G. U.	Thirukkural with English Translation	Uma Publication, Thanjavur.	2002

#### **Course Objectives**

- To motivate learners to acquire listening & speaking skills inboth formal and informalcontext.
- To focus on question forms & to make them understand the importance of using question tags and also the functional use of transformation ofsentences.
- To improve their reading habit and to train them in critical and analyticalreading.
- To equip them to write for academic as well as work placecontext.
- To enable students to faceinterviews.
- To study the receptive and productive skills

#### **Course Outcomes**

Students undergoing this course will be able to

- Acquire second language: speaking convincingly, expressing their opinions clearly, negotiating and arguing using appropriate communicativestrategies.
- Enhance them reading texts critically and analytically.
- Develop writing effectively, persuasively and producing different types of writing such as narratin, description, exposition and argument as well as creative, critical, analytical and evaluativewriting.
- Producing different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluativewriting.
- Enrich the ability to face interviews with confidence.
- Ensure the good communication with the society.

#### UNIT-1

#### (10)

(9)

Listening - Difference between Hearing & Listening –Listening to informal conversation. Speaking -Spoken structures on different situations - Introduction, Greeting, Comments on topics like Films, Games etc, Excuse, Request, Agreement, Disagreement, etc., **Reading** – Extensive and Intensive reading. Writing – Report writing - Writing a covering letter. Grammar – Regular & Irregular verbs - Kinds of sentences -Question tags. Vocabulary – Homonyms and Homophones.

#### **UNIT-II**

**Listening** – Note Taking- Improving grasping ability. **Speaking** – Welcome address - Vote of thanks - Master of ceremony. **Reading** – Active and Passive reading - Reading for vocabulary- Reading for a purpose. **Writing** - Writing a review (Film review) - Summary of a story. **Grammar** - Modal verbs – Conjunction - Expression of cause and effect. **Vocabulary** - Phrasal verbs - Idioms.

#### UNIT – III

Listening - Barriers to listening (Physical, Psychological, Linguistic & Cultural). Speaking – Stress, Pause and Intonation. Reading – Rapid reading – Skimming, Scanning and Surveying. (SQ3R)Writing - Essay writing -Minutes of meeting - Agenda – Grammar - Active and Passive voice - Purpose expression. Vocabulary - Same words used as noun and verb - Often misspelt and confused words.

(8)

#### UNIT-IV

Listening – Listening to telephone conversation - Viewing model interviews. Speaking – Group Discussion - Correlation between verbal & non - verbal communication. Reading – Reading comprehension (short & long text) - Reading job advertisements and profile of a company. Writing – Job application - Resume writing - Checklist preparation. Grammar - Numerical expressions – Collocations - Vocabulary - Singular and Plural (Nouns)

#### UNIT- V

Listening – Types of listening- Improving listening comprehension. Speaking - Oral presentation - Vocal communication techniques - Voice, quality, volume, pitch etc., Reading -Note making - Making notes from books/ any forms of writing materials. Writing - Describing process & products - Recommendation writing – Short essays writing- Grammar- Transformation of sentences (Simple, Compound & Complex). Vocabulary - Collection of Technical Vocabularies with their meanings.

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

TEXT	BO	OK:
TEXT	BO	OK

S. NO.	AUTHOR(S) NAME	TI BC	FLE O	F	THE	PUBLISHE	R	YE PU	AR BLIC	OF ATION	RE
1	<u>Sangeeta</u>	Tee	chnical			OUP,		201	5		
	<u>Sharma</u> ,	Co	mmunica	tion	<u>ı:</u>	New Delhi.					Er
	Meenakshi	Pri	nciples		And						CES
	Raman	Pra	ctice								:
		$2^{nd}$	Edition							1	
S.	AUTHOR(S) NAM	ME	TITLE	OF	THE	PUBLISH	ER	YEA	R	OF	
NO.			BOOK					PUB	LICA	ΓΙΟΝ	
1	Lakshminarayanan	,	Commu	nic	ation	SCITECH	Publications,	2008			
	K.R. & Murugavel	, T.	Skills		for	Chennai					WED
	_		Enginee	ers							
2	Rizvi Ashraf, M		Effectiv	e		Tata McGr	aw-Hill,	2007			1165 :
www.l	earnerstv.com – List	enin	g/ Speaki	ing/	<sup>'</sup> Preser	tation <sup>/</sup> Delhi.					
www.i	n <u>Buthenford An</u> drea	<u>v riti</u> oeab	uBarşiEnr	rich	ment/ S	Speakingn Ed	lucation, New	2006			
www.i	speakyouspeak.blog	<u>spot</u>	Commu Strille	Bici	atinary	EArchiment/	Speaking				
www.t	eachertube.com – W Dictionary.com – Ser	ritin mant	g Technic i Technol	call PSJ	y <sup>101</sup> r						

# (10)

Total: 45

#### **Course Objectives:**

- 1. To have knowledge in integral calculus and Vectorcalculus
- 2. To expose the concept of Analytical function and Complexintegration.
- 3. The syllabus is designed to develop the use of integrals techniques which is needed by Engineers for practical applications.

**ENGINEERING MATHEMATICS II 3 2 0 4 100** 

- 4. It aims to equip the students in integration to solve engineering problems
- 5. To learn Basic concepts of multiple and vector integrals.
- 6. To study complex integration

#### **Course Outcomes:**

The student will be able to

- 1. Solve problems in Fluid Dynamics, Theory of Elasticity, Heat and MassTransfer etc.
- 2. Find the areas and volumes using MultipleIntegrals
- 3. Improve their ability in Vectorcalculus
- 4. Expose to the concept of Analyticalfunction.
- 5. Apply Complex integration in their Engineeringproblems
- 6. Analysis the real time application of it.

#### UNIT-I PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constantcoefficients.

#### **MULTIPLE INTEGRALS UNIT-II**

Double integral - Cartesian coordinates - Polar coordinates - Change of order of integration - Triple integration in Cartesian co-ordinates - Area as double integrals.

#### **UNIT-III VECTOR CALCULUS**

Gradient, Divergence and Curl - Directional derivative - Irrotational and Solenoidal vector fields - Vector integration - Green's theorem, Gauss divergence theorem and Stoke's theorems (Statement Only)- Surfaces : hemisphere and rectangular parallelopipeds.

#### UNIT-IV **ANALYTIC FUNCTIONS**

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms - Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions - Constructions of an analytic function -Conformal mapping: w = z+a, az, 1/z,  $z^2$  and bilinear transformation.

#### **UNIT-V COMPLEX INTEGRATION**

Complex Integration - Cauchy's integral theorem and integral formula (Statement Only) - Taylor series and Laurent series - Residues - Cauchy's residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi circle (excluding poles on the real axis).

### (13)

**Total : 60** 

#### (13)

(11)

(11)

#### (12)

#### **TEXT BOOKS:**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hemamalini. P.T	Engineering Mathematics I & II	McGraw-Hill Education Pvt.Ltd, New Delhi	2014
2	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2014

#### **REFERENCES:**

S.	Author(s) Name	Title of the book	Publisher	Year of
No.				Publication
1	Erwin Kreyszig	Advanced Engineering	John Wiley & Sons.	2011
		Mathematics.	Singapore	
2	Venkataraman, M. K.	Engineering	The National	2005
		Mathematics.	Publishing Company,	
			Chennai	
3	Narayanan. S,	Advanced	Viswanathan	2002
	Manicavachagam	Mathematics for	S.(Printers and	
	pillay.T.K and	Engineering Students.	Publishers) Pvt. Ltd.	
	Ramaniah.G		Chennai.	
4	Michael D.	Advanced Engineering	Pearson Education,	2009
	Greenberg	Mathematics	India	

#### **WEBSITES:**

- 1.www.efunda.com
- 2. www.mathcentre.ac.uk
- 3. www.sosmath.com/diffeq/laplace/basic/basic.html
- 4. www.mathworld.wolframe.com

### MATERIALS SCIENCE

# **COURSE OBJECTIVES:**

**15BECC203** 

- 1. To impart knowledge on aspects of materials.
- 2. To understand various types of Conducting Material.
- 3. To familiarize on Semiconducting Materials.
- 4. To impart knowledge on Magnetic and Superconducting Material
- 5. To learn about the Dielectric Materials.
- 6. To comprehend the significance of Advanced Materials.

## COURSEOUTCOMES:

Learners should be ableto

- 1. Identify the aspects of materials.
- 2. Identify suitable types of Conducting Material.
- 3. Select appropriate Semiconducting Materials for variousapplications.
- 4. Identify and select Magnetic and Superconducting Material.
- 5. Identify suitable Dielectric Materials.
- 6. Significance of Advanced Materials.

## UNIT I CONDUCTING MATERIALS

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

(9)

## UNIT II SEMICONDUCTING MATERIALS (9)

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

## UNIT III MAGNETIC AND SUPERCONDUCTING MATERIAL

Origin of magnetic moment – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.

Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Temperature superconductors – Applications of superconductors – magnetic levitation.

## UNIT IV DIELECTRIC MATERIALS

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials – ferroelectricity and applications.

(9)

# UNIT V ADVANCED MATERIALS (9)

Metallic glasses: preparation, properties and applications.

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, applications.

Composite materials, Aircraft materials and non-metallic materials.

Nano materials: synthesis – Physical and chemical vapour deposition – ball milling - properties of nanoparticles and applications. Carbon nanotubes: structure – properties and applications.

## Total: 45

(9)

### **TEXT BOOK:**

S.No	Author(s) Name	Title of the book	Publisher	Year of
				Publication
1	Ganesan.S and	Engineering Physics II	GEMS Publisher,	2 <sup>nd</sup> Edition-
	Baskar.T		Coimbatore-641 001	2015

#### **REFERENCES:**

S.No	Author(s) Name	Title of the book	Publisher	Year Publica	of tion
1	William D Callister Jr	Material Science and Engineering-An Introduction	John Wiley & Sons Inc., New York.	9 <sup>th</sup> 2013	Edition
2	James F Shackelford	Introduction to Materials Science for Engineers	Macmillan Publication Company, New York	8 <sup>th</sup> 2014	Edition
3	Charles Kittel	Introduction to Solid State Physics	John Wiley & sons, Singapore.	8 <sup>th</sup> 2005	Edition

#### **WEBSITES:**

- www.nptel.ac.in
  www.physicsclassroom.com
  www.oyc.yale.edu
  www.physics.org

#### **Course Objectives:**

- To give a comprehensive insight into natural resources, ecosystem andbiodiversity.
- To educate the ways and means of theenvironment
- To protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfaremeasures.
- To create the awareness about environmental problems among people.
- To motivate public to participate in environment protection and improvement.

#### **Course Outcomes (COs)**

#### Upon completion of the course the students will be able to

- 1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- 2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- 3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- 4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- 5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- 6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- 7. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.

#### UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, Scope and Importance – Need for public awareness -Forestresources: Useandover-exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources- role of an individual in conservation of natural resources.

#### UNIT II ECOSYSTEM

Chemistry and Environment-Environmental segments, Composition and Structure of atmosphere-Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, Food web and Ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

(9)

(9)

#### UNIT III BIODIVERSITY

Introduction to biodiversity, Definition- Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic Species of India – Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

#### UNIT IV ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management-causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Disaster management-earthquake, tsunami, cyclone and landslides.

#### UNIT V SOCIAL ISSUES AND ENVIRONMENT

FromUnsustainable to Sustainable development, Urban problems related to energysources, Water conservati on, Rain water harvesting and Watershed management, Resettlement and rehabilitation of people, its problems and concerns, Environmental ethics- Issues and possible solutions- Climate change- Green house effect and Global warming, Acid rain, Ozone layer depletion, Wasteland reclamation- Environment Protection Act- Human Rights- Value education, Role of Information Technology in Environment and Human health-Population growth, Variation of population among nations-Population explosion.

Total: 45

	DOORD.			
S.No	Author(s) Name	Title of the book	Publisher	Year of
				Publication
1.	Dr. Ravikrishnan,	Environmental	Sri Krishna Hi tech Publishing	2012
	А	Science	Company Private Ltd.,	
			Chennai	
2.	Anubha kaushik	Environmental	New Age International (P)	2010
	C.P. Kaushik	Science and	Ltd., New Delhi.	
		Engineering		

#### **TEXT BOOKS:**

#### **REFERENCES:**

S.No	Author(s) Name	Title of the book	Publisher	Year of
				Publication
1.	William	Principles of	Tata Mc Graw -Hill Publishing	2008
	P.Cunningham	Environmental	Company, New Delhi.	
		Science		
2.	Linda D. Williams	Environmental	Tata Mc Graw -Hill Publishing	2005
		Science Demystified	Company Ltd., New Delhi.	
3.	Bharucha Erach	Environmental	Mapin Publishing (P) Ltd.,	2005
		Science Demystified	Ahmedabad.	
4.	Tyler Miller G. Jr	Environmental	Thomson & Thomson	2004
		Science	Publishers, New Delhi.	
5.	Trivedi, R.K. and	Introduction to Air	Techno-Science Publications,	2003
	Goel, P.K	Pollution	Jaipur.	

#### **WEBSITES:**

- 1. http://people.eku.edu/ritchisong/envscinotes1.html
- 2. http://nptel.ac.in/courses.php?disciplineId=120
- 3.www.newagepublishers.com/samplechapter/001281.

 $4. \underline{www.unesco.org/ext/field/beijing/scienceb.htm, www.infinitepower.org/education.htm}$ 

#### (**9**) oil

(9)

#### 15BEAE205

#### ENGINEERING MECHANICS 3 2 0 4 100

#### Course Objectives:

- To familiarise the basic concepts and force systems in a real-world environment.
- To impart knowledge on the equilibrium of rigid bodies.
- To learn the concept of centroid, centre of gravity and moments of inertia.
- To understand the rectilinear motion and curvilinear motion.
- To enrich the understanding of dynamic forces exerted in rigid body
- To provide knowledge on the friction.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Determine the resultant force and moment for a given system of forces.
- Analyse the plane trusses having different types of supports and determine the forces in each member.
- Identify the location of centroid, centre of gravity and calculate the moment of inertia for different sections.
- Apply the equations of motion of particles to calculate displacement, velocity and acceleration.
- Calculate dynamic forces exerted in rigid body
- Determine the friction and its effects by using the laws of friction.

#### UNIT I STATICS OF PARTICLES (12)

Forces – system of forces - concurrent forces in plane and space- resultant - problems involving the equilibrium of a particle-free body diagram-equilibrium of particle in space.

#### UNIT II STATICS OF RIGID BODIES IN TWO DIMENSIONS (12)

Rigid bodies-two dimensional structure-moment of force about an axis-moment of a couple-equivalent system of coplanar forces-Rigid body in equilibrium-problems involving equilibrium of rigid body-types of supports-reactions of beams and frames.

APPLICATION OF STATICS: Roof trusses-Method of joints, method of sections and Tension coefficient method.

#### UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA

#### (12)

Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

#### UNIT IV KINEMATICS OF PARTICLES

Introduction-plane, rectilinear motion - time dependent motion-rectangular coordinates-projectile motion.

(12)

IMPULSE AND MOMENTUM: Concept of conservation of momentum- Impulse-Momentum principle-Impact-Direct central impact-oblique central impact.

#### UNIT V FRICTION

(12)

Laws of friction-coefficient of friction-problems involving dry friction- wedge and ladder friction. KINETICS OF PARTICLES: Equation of motion-rectilinear motion-Newton's II law – D'Alembert's principle- Energy - potential energy-kinetic energy-conservation of energy-work done by a force - work energy method.

#### Total: 60

#### **TEXT BOOKS:**

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
1.	Ferdinand Beer, David Mazurek,	Vector Mechanics for Engineers-Statics and	Science Engineering and	PUBLICATION
	Jr.,E.Russell Johnston, Phillip Cornwell	Dynamics	Math	2013
2.	Rajasekaran S	Engineering Mechanics- Statics and Dynamics	Vikas Publishing House Pvt. Ltd., New Delhi	2009

#### **REFERENCE BOOKS:**

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Dr.R.K.Bansal and	A Textbook of Engineering	Laxmi	
	Sanjai bansal	Mechanics	Publications Pvt.	2013
			Ltd.,	2015
			New Delhi	
2.	Bhavikatti S S.	Engineering Mechanics	New Age	
			International Pvt.	2012
			Ltd.,	2012
			New Delhi	
3.	Young D H.,S	Engineering Mechanics	McGraw- Hill	
	Timoshenko,		Education(India)	2012
	J.V.Rao and		Private Limited,	2015
	Sukumar Pati		New Delhi	
4.	Jivan Khachane and	Engineering Mechanics	ANE Books,	
	Ruchi Shrivastava		New Delhi.	2008
#### 15BEAE206 COMPUTER FUNDAMENTALS AND C PROGRAMMING3 0 0 3 100

#### Course Objectives:

- To identify and understand the working of key components of a computer program.
- To identify and understand the various kinds of keywords and different data types of C programming.
- To understand, analyse and implement software development tools like algorithm, pseudo codes and programming structure.
- To study, analyse and understand the logical structure of a computer program, and different construct to develop a program in C language.
- Understand, analyze and implement software development tools like algorithm, pseudo codes and programming structure.
- Study, analyze and understand logical structure of a computer program, anddifferent construct to develop a program in 'C' language

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Formulate simple algorithms for arithmetic and logical problems.
- Translate the algorithms to programs (in C language).
- Test and execute the programs and correct syntax and logical errors.
- Implement conditional branching, iteration and recursion.
- Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- Apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

#### UNIT I Overview of Computer

What is computer- Computer Components-Generation of Computers- Memory Organization-Memory Types-Input and Output Devices- Concepts of Hardware and Software- What is OS-Windows and Unix OS-Programming Languages- Basics of Computer Networks- LAN, WAN-Concept of Internet- ISP- Basics of word processing- Basics of spreadsheet – Basics of presentation Software

#### UNIT II Overview of 'C'

Algorithms-Representation of Algorithms-Flowchart- Introduction to programming Languages-What is C- C Character set- Constants, Variables and Keywords-General form of C Program-The First C Program-Data types-Arithmetic Instructions- Type conversions- Relational and Logical Operators-Hierarchy and associativity

#### UNIT III Selection and Iteration

8

8

Selection Structures- If and nested if - Loops-Definition and types-While loop-for loop- do-while loop- break and continue- Nested loops- Advantages of iteration-Menu driven programs-Switch Case

# UNIT IV Functions

# Functions- Definition-types-Functions without arguments- Functions with Input arguments- Functions with output parameters-local and global variables- advantages of functions- Call by value and Call by reference-Recursion- Function as an argument

#### UNIT V Arrays and Strings

Arrays-definition- Declaring and referencing arrays- Array initialization- Using for loops for accessing arrays-Passing array elements as function arguments-2D Array - Matrix Addition and multiplication-Introduction to Strings- declaration and Initialization--String constant -Strings as Array of Characters

#### **Total Hours: 45**

#### **Text Books:**

- 1. H. M. Deitel and D. J. Deitel, 'C: How to Program', Prentice Hall, 7th Edition, 2012
- 2. Yashavant Kanetkar, "Let us C", BPB Publications, 13<sup>th</sup> Edition, 2013

#### **References:**

- E. Balagurusamy, "Computing Fundamentals and C Programming", TMH Education, 5<sup>th</sup> Edition, 2014
- 2. E. Balagurusamy, "Programming in ANSI C", TMH Education, 6<sup>th</sup> edition, 2012

#### 10

#### 10

# **Course Objectives**

- Identify and understand the working of key components of a computer program.
- Identify and understand the various kinds of keywords and different data types of C programming
- Understand, analyze and implement software development tools using algorithm
- Understand, analyze and implement software development tools using linux
- Acquire and analyse the roots of equations
- Study, analyze and understand logical structure of a computer program, and different construct to develop a program in "C" language

#### **Course Outcomes:**

The course will enable the students.

- 1. To formulate simple algorithms for arithmetic and logical problems.
- 2. To translate the algorithms to programs(in C language).
- 3. To test and execute the programs and correct syntax and logical errors.
- 4. To implement conditional branching, iteration and recursion.
- 5.To decompose a problem in to functions and synthesize a complete program using divide and conquer approach. and use arrays, pointers and structures to formulate algorithms and programs.
- 6.To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

# List of Experiments

- 1. Working with word Processing, Spreadsheet and presentation software in Linux.
- 2. Programming in Scratch:

Practicing fundamental concepts of programming like sequence, selection decision statements, working of loops and event driven programming.

3. C Programming:

Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input and Output Formatting, Decision Statements, Switch Case, Control structures, arrays, Strings and function.

**Total Hours: 45** 

- To explain the surfaces for sheet metal working applications.
- To Understand the representation of details in machine drawing.
- To introduce tolerances and fits of machine elements.
- To equip them with skills to Construct an assembly drawing using part drawings of machine components.
- To equip them with skills to Construct an assembly drawing of machine components using 2D drafting.
- To Understand various Cam Profile

#### Course Objectives:

#### Course Outcomes:

- Draw the surfaces for sheet metal working applications.
- Understand the representation of details in machine drawing.
- Represent tolerances and fits of machine elements.
- Construct an assembly drawing using part drawings of machine components.
- Construct an assembly drawing of machine components using 2D drafting
- Understand the various Cam Profile

#### UNIT I CONVENTIONS

Importance of sectional views, Code of practice for engineering drawing, drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

# UNIT II ASSEMBLY CONCEPTS AND DRAWING PRACTICE

Methods and concepts of assemblies-assembly requirements, Bill of materials. Methods of assembly-bolts, nuts, studs, screws and pins. Methods of arresting motion of a member in an assembly. Drawing Practice of flange coupling, universal coupling, oldhams coupling, swivel bearing, stuffing box, knuckle joint, C clamp, plummer block, screw jack, simple drill jig.

# UNIT III FITS AND TOLERANCES

Limits, fits and tolerances-need, types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances. Geometric tolerance-uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings. Surface finish symbols- methods of indicating the surface roughness.

#### UNIT IV SOLID MODELING

Modelling of flange coupling, universal coupling, oldhams coupling, swivel bearing, stuffing box, knuckle joint, C clamp, plummer block, screw jack, simple drill jig.

# UNIT V CAM PROFILE

Classifications, displacement diagrams-parabolic, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife - edged, roller, mushroom, flat type, derivatives of follower motion, pressure angle and undercutting.

# **TEXT BOOKS:**

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Gopalakrishna K R	Machine Drawing Seventeenth Edition	Subhas Stores, Bangalore	2003
2.	Narayana K L, Kannaiah P, Venkata Reddy K	Machine Drawing	New Age International	2006.

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Varghese P I and John K C	Machine Drawing	Jovast Publishers, Thrissur	2007
2.	BIS	SP:46-2003	Engineering Drawing Practice for Schools and Colleges, New Delhi	2003
3.	ASME Y 14.5M- 1994	Dimensioning and Tolerancing	ASME, New York	1995

#### 15BECC251

# **INTENDEDOUTCOMES:**

• Tounderstand the basics of biomolecules, human anatomy and physiology

**ELEMENTARYBIOLOGY** 

Tohavebetterunderstandingofadvancementsinbiology

# UNIT-I BASICSOFCELLBIOLOGY

History, Cell Structure-Prokaryotic and Eukaryotic cells, Animal and Plant Cell. Cell cycle, Mitosis, Meiosis and Reproductive cycle.

# **UNIT-II BIOMOLECULES**

Carbohydrates-Classification, Qualitativetests for sugars, Lipids-Definition, Classification; Proteinsclassification and functions; Nucleicacids-basic structure; Hormones-definition, importance; Vitamins.

# UNIT-IIIHUMANANATOMYANDPHYSIOLOGY

Levels of Structural organization, the eleven systems of human body, central nervous system-cardiovascularsystemandimmunesystem.

# UNIT-IV GENETICSANDGENETICDISORDERS

Historyof genetics-Scopeand Importanceof genetics, Mendelandhiswork, DNAstoresgenetic information-genemutation, disorders due to mutantgenes.

# UNIT-V TECHNOLOGICALADVANCESINBIOLOGY

Biopharmaceuticals, Genetherapy, genetically modified crops, probiotics.

# **TEXTBOOK:**

S.NO	AUTHOR(S)NAME	TITLEOFTHEBOOK	PUBLISHER	YEAROF PUBLICATION S
1	Verma,P.S., Agarwal,V.K.	CellBiology,Genetics, MolecularBiology, EvolutionandEcology	S.Chand &Company Ltd.,New Delhi	2006

# **REFERENCEBOOKS:**

S.NO	AUTHOR(S)NAME	TITLEOFTHEBOOK	PUBLISH ER	YEAROF PUBLICATION S
1	Nelson,D. L.andCox,M.M	LehningerPrinciplesof Biochemistry4 <sup>th</sup> Edition	Freeman, W.H.&Co mpany, Ney york	2004

(4)

(5)

(4)

Total: 20

(4)

(3)

2	Tortora,G.J.,Derrickson,B	PrinciplesofAnatomy andPhysiology, 11 <sup>th</sup> Edition	John Wiley&Son s. New	2006
			York	

# WEBSITE

1. <u>http://www.biotechonweb.com/Application-of-biotech-in-Medical.html</u>

#### **Course Objectives:**

- To hone the analytical skills in the minds of Engineers.
- To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyze Engineeringproblems.
- To study the fourier series
- To study the basic principles of differenttransforms.
- To study the application of PDE
- To study the difference equations

#### **Course Outcomes:**

Upon Completion of this course the students will be ableto:

1. Explain the fundamental concepts of probability and standard distributions which can describe real life phenomenon.

2. Explain the basic concepts of one- and two-dimensional random variables and their applications in engineering.

3. Apply the concept of testing of hypothesis for small and large samples in real life problems.

4. Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.

5. Discuss the notion of sampling distributions and statistical techniques used in engineering and management problems.

6. Discuss about the techniques in quality control that model engineering problems

#### UNIT- I LAPLACE TRANSFORM

Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and final value theorems. Inverse Laplace transforms – Convolution theorem (statement only) – Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms – Transform of periodic functions.

#### UNIT- II FOURIER SERIES

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

#### UNIT -III FOURIER TRANSFORM

Fourier integral theorem (Statement Only) – Fourier transform pair –Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity – Relation between Fourier and Laplace transforms

#### UNIT- IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12)

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded)

#### UNIT- V Z-TRANSFORM AND DIFFERENCE EQUATIONS (10)

 $Z-transform-Elementary\ properties-Inverse\ Z-\ transform-Convolution\ theorem\ -Formation\ of\ difference\ equations-Solution\ of\ difference\ equations\ using\ Z-\ transform.$ 

# (12)

(12)

(13)

# **TEXT BOOKS:**

S.	Author(s) Name	Title of the book	Publisher	Year of
No.				Publication
1	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2013
2	Erwin Kreyszig	Advanced Engineering Mathematics.	Wiley India (P) Ltd, New Delhi.	2014

# **REFERENCES:**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venkateswarlu S	Engineering	Anuratha Agencies and	2007
		Mathematics, Vol I	Publishers,	
			Kumbakonam.	
2	Narayanan, S.,	Advanced	Viswanathan S	2002
	Manicavachagom	Mathematics for	Printers and Publishers	
	Pillay, T.K. and	Engineering Students.	Pvt. Ltd. Chennai.	
	Ramaniah, G	Volumes II and III,		
3	Bali N P., Manish	A text book of	Laxmi Publications Pvt.	2006
	Goyal	Engineering	Ltd., New Delhi	
		Mathematics		
4	Ramana B V	Higher Engineering	Tata Mc Graw Hill	2008
		Mathematics	Publishing Co. Ltd. New	
			Delhi.	

# **WEBSITES:**

- 1. www.sosmath.com
- 2. <u>http://mathworld.wolfram.com/FourierSeries.html</u>
- 3. www.nptel.ac.in

#### 15BEAE302

#### STRENGTH OF MATERIALS

#### Course Objectives:

- To study and estimate the mechanical properties of materials and their deformations under different loading conditions.
- To gain knowledge on the shear force and bending stress distribution in different beams under various loads.
- To impart knowledge on finding slope and deflection of beams and buckling of columns for various boundary conditions.
- To learn deformation of the shaft under torsion and deflection of closed helical springs.
- To acquire knowledge on the two-dimensional stress systems and stresses in thin cylinders and spherical shells.
- To introduce the concepts of Mohr's circle

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Evaluate the stresses and strains in simple and composite structures subjected to axial loads.
- Examine the shear force, bending moment and shear stress of various beams under different loading conditions.
- Examine the stresses induced in the shaft and closed coil helical springs subjected to torsion.
- Evaluate the slope and deflection of beams and buckling loads of columns with different boundary conditions.
- Examine the stresses in two-dimensional systems and thin cylinders.
- Familiar with construction of Mohr's circle

#### UNIT I STRESS STRAIN AND DEFORMATION OF SOLIDS

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

#### UNIT II BEAMS - LOADS AND STRESSES

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

#### UNITIII TORSION

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

# UNIT IV BEAM DEFLECTION

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

#### UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TEXT BOOKS					
SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION	
1.	Popov .E.P	Engineering Mechanics of Solids	Prentice-Hall of India,New Delhi	1998	
2.	Punmia .B.C, Ashok Kumar Jain and Arun Kumar Jain	Strength of Materials and Theory of Structures-Vol.2	Laxmi Publications, New Delhi	2005	
3.	Ferdinand Beer, E. Russell Johnston Jr., John DeWolf and David Mazurek	Mechanics of Materials,7 <sup>th</sup> Edition	McGraw-Hill Book Co, New Delhi.	2014	

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William Nash,Merle	Theory and problems in	McGraw-Hill	2011
	Potter	Strength of	Book Co,New	
		MaterialsSchaum Outline	York.	
		Series		
2.	Kazimi S.M.A	Solid Mechanics	Tata McGraw-	2001
			Hill Publishing	
			Co., New Delhi.	
3.	Ryder G.H	Strength of Materials	Macmillan India	2002
			Ltd, New Delhi	
4	Timoshenko.S.P.	Elements of Strength of Materials',5th Edition	East West,India	2003

#### 15BEAE303 ENGINEERING THERMODYNAMICS

3104100

# Course Objectives:

- To understand the Model of physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
- To provide knowledge on entropy change in thermodynamic processes.
- To Study and acquire knowledge on various thermodynamic properties of pure substances in real time problems.
- To establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
- To facilitate the understanding of properties of air using psychometric chart.
- To acquaint the student with the concepts and applications of the thermodynamics to the various real life systems.

#### Course Outcomes:

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

- Model the physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
- Determine entropy change in thermodynamic processes.
- Identify the various thermodynamic properties of pure substances in real time problems.
- Establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
- Calculate the properties of air using psychometric chart.
- Explain the basic principles and applications of the thermodynamics to the various real life systems.

#### UNIT I BASIC CONCEPTS AND FIRST LAW

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

# UNIT II SECOND LAW, ENTROPY AND AVAILABILITY

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, Rankine cycle ,efficiency, COP.Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability.

#### UNIT III PROPERTIES OF PURE SUBSTANCE AND IDEAL & REAL GASES

Properties of steam, Pure substance, phase, phase change process, property diagrams, PVT surface. Gas mixtures- properties of ideal and real gases, equation of state, Avagadro's law, Vander Waal's equation of

states, compressibility and its chart. Dalton's law of partial pressure, exact differentials, T-D, relations, Maxwell relations, Clausius Clapeyroni equations, Joule Thomson Coefficient, Dryness fraction

# UNIT IV PSYCHROMETRY

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrometric processsensible and latent heat exchange processes.

# UNIT V GAS DYNAMICS

Energy and momentum equations of compressible fluid flows-stagnation state, Mach number, Mach cone, effect of Mach number on compressibility, isentropic flow through variable area ducts, (Descriptive study-Rayleigh, Fanno flow, normal shocks).

(Use of standard Steam table, Mollier diagram, Psychometric chart and Gas table are permitted in the examination)

# TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Nag.P.K	Engineering	McGraw-Hill	2013
		Thermodynamics-5 <sup>th</sup>	Education	
		Edition	(India) Private	
			Limited	
2.	Rathakrishnan.E	Fundamentals of	Prentice-Hall of	2005
		Engineering	India, New	
		Thermodynamics	Delhi	
3.	Yahya, S.M,	Fundamentals of	New Age	2003
		Compressible Flow	International (P)	
			Ltd., New Delhi	

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Holman J P	Heat Transfer	McGraw Hill	2009
			Education	
2.	Arora.C.P	Thermodynamics	Tata McGraw-	2003
			Hill, New Delhi.	
3.	Cohen. H., Rogers	Gas Turbine Theory	Prentice-Hall of	2008
	G.F.C and		India, New	
	Saravanamuttoo.H.I.H		Delhi	
	and Paul Straznicky			

#### Course Objectives:

- To impart basic knowledge on the construction and operation of two-stroke and four-stroke engines.
- To study various components of the fuel feed system.
- To learn the combustion process and types of combustion chambers.
- To provide knowledge on the supercharging, turbocharging and engine testing.
- To familiarise the types of cooling and lubrication systems.
- To provide knowledge on modern engine technologies

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Differentiate the construction and operation of two-stroke and four-stroke engines.
- Name and explain various components of the fuel feed system.
- Discuss the combustion process and combustion chambers.
- List and describe the different methods of supercharging and turbocharging.
- Explain the importance of cooling system.
- Explain the importance of lubrication system.

# UNIT I ENGINE CONSTRUCTION AND OPERATION

Constructional details of four stroke petrol and diesel engine, working principle, air standard Otto cycle, actual indicator diagram, two stroke engine construction and operation, comparison of four stroke and two stroke engine, firing order and its significance. Port Timing, Valve Timing of petrol and diesel engines.

# UNIT II FUEL FEED SYSTEM

Carburettor working principle, requirements of an automotive carburettor, starting, idling, acceleration and normal circuits of carburettors. Compensation, maximum power devices, constant choke and constant vacuum carburettors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)-Jerk pumps, distributor pumps, pintle and multihole nozzles, Unit injector and common rail injection systems. Injection pump calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

#### UNITIII COOLING, LUBRICATION AND IGNITION SYSTEM

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, forced circulation system, pressure cooling system. Lubrication system; Mist, Dry sumpand wet sump lubrication system, properties of lubricants.

Types of ignition systems and its working battery coil,magneto and electronic ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs.

#### UNIT IV COMBUSTION AND COMBUSTION CHAMBERS

Combustion in SI engine; stages of combustion, flame propagation, Delay period, Uncontrolled combustion, Effect of Delay period, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on

knock, knock rating. Combustion chambers; different types, Combustion in CI Engines, Direct and indirect injection combustion chambers for CI engines. Importance of Swirl, squish and turbulence. Factors considering combustion chamber design.

**UNITV SUPERCHARGING, TURBOCHARGING AND ENGINE TESTING** Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls - wastegate, variable geometry, variable nozzle types.Dynamometers, indicated thermal, brake thermal and volumetric efficiencies.Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards.

#### **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Ganesan.V	Internal Combustion	Tata McGraw-	2012
		Engines	Hill Publishing	
			Co., New Delhi	
2.	Mathur .M.L and	A course in internal	Dhanpat Raj&	2001
	R.P.Sharma	combustion engines	Sons	
			Publications,	
			New Delhi	
3.	Heinz Heisler	Advanced Engine	Butterworth-	1998
		Technology	Heinemann	

SL.NO.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1.	John B. Heywood	Internal Combustion	McGraw-	2011
		Engine Fundamental	HillEducation(India)	
			Private Limited.	
2.	Heldt.P.M	High Speed Combustion	Oxford &IBH	1965
		Engines: Design,	Publishing	
		Production, Test	Company	
3.	Obert.E.F	Internal Combustion	International Text	1988
		Engines Analysis and	Books Co.,	
		Practice	Scrantron,	
			Pennsylvania	
4.	William	Automotive Engines	McGraw-Hill	2006
	H.Crouse,1985		Publishers.	
5.	Ellinger.H.E	Automotive Engines	Prentice Hall	1992
			Publishers.	
6.	Pulkrabek	Engineering	Practice Hall of	2003
		Fundamentals of the	India.	
		Internal Combustion		
		Engines		

# 15BEAE305TWO AND THREE WHEELER TECHNOLOGY3 0 0 3 100

#### **Course Objectives:**

- To impart technical knowledge on construction and working of the power train and drive train of two and three wheeler vehicles.
- To familiarise with maintenance procedures of the engine and subsystems of two and three wheelers.
- To impart knowledge on types of transmission systems
- To impart knowledge on types of steering and suspension systems
- To impart knowledge on types of wheels, tyres and brakes for two and three wheelers
- To make the students conversant on servicing of two and three wheelers.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Construct the frames of two and three wheelers of different layouts.
- Demonstrate the constructional details and principle of operation of various engine components.
- Identify and explain the types of transmission systems.
- Identify and explain the types of steering and suspension systems.
- Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
- Explain the servicing of two and three wheelers.

#### UNIT I INTRODUCTION

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

#### UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

#### UNIT III CLUTCHES AND TRANSMISSION

Types of clutches for 2 and 3 wheelers. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

#### UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

#### UNIT V THREE WHEELERS

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment type types. Brakes and their operating mechanism.

#### **TEXT BOOKS:**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Irving P.E.	Motor Cycle Engineering.	Temple Press Book, London.	1992.
2.	Srinivasan.S.	Motor cycle, Scooter, Mobeds.	New century book house.	1988.

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	M.M.Griffin.	Motor cycles from inside and outside.	Prentice Hall Inc, NewJersey.	1978.
2.	Bruce A. Johns, David D.Edmundson and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

#### 15BEAE311STRENGTH OF MATERIALSLABORATORY0 0 3 2 100

#### Course Objectives:

- To understand Various material properties.
- To acquire the ability to determine the behavior of components for applied load.
- To expose students to different types of beams with various load condition.
- To expose students tostrain energy, stress distribution & deformation in spring and shaft
- To provide an overview of slope and beam deflection.
- To make the student acquire sound knowledge ontypes of stresses

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Understand Various material properties
- Apply the principles of solid mechanics, to determine the behavior of components for applied load.
- Compute the shear force and bending moment for different types of beams with various load condition and also sketch the SF and BM diagram.
- Calculate the strain energy, stress distribution & deformation in spring and shaft.
- Use the appropriate method to determine slope and beam deflection for different beam sections.
- Solve the problem in principal planes & stresses using analytical & graphical method and determine the different types of stresses involved in thick cylinders & thin cylinders.
- 1. Tensile test on metals-stress strain characteristics, ductility, resilience, toughness.
- 2. Cupping test on metal sheets-load deformation characteristics, cupping load, cupping number.
- 3. Hardness test on metals-Brinell, Vicker and Rockwell Hardness tests.
- 4. Impact test on metals-Charpy, Izod impact tests.
- 5. Shear test on metals-direct shear strength, single shear, double shear.
- 6. Tests on helical springs-compression, tension springs-load deformation characteristics, stiffness, shear stress, modulus of rigidity, energy.
- 7. Torsion test on beams-torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
- 8. Microscopic examination of i)Hardened samples ii)Hardened and tempered samples.
- 9. Tempering Improvement of Mechanical properties Comparison for
- i) Unhardened specimen ii) Quenched specimen iii) Quenched and tempered specimen.
- 10. Study of low carbon steel and medium carbon steel

# 15BEAE312 AUTOMOTIVE ENGINE COMPONENTS LABORATORY0 0 3 2 100

#### Course Objectives:

- To expose students to 4 cylinder petrol and 6 cylinder diesel engines .
- To provide knowledge on Fuel systems
- To provide knowledge onignition system.
- To learn the engine cooling system components
- To study the engine lubrication system.
- To impart knowledge on cylinder bore and engine crank shaft.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Dismantling and Assembling procedure of 4 cylinder petrol and 6 cylinder diesel engines
- Knowledge on Fuel systems
- Knowledge onignition system
- Study on engine cooling system components
- Study the engine lubrication system
- Knowledge on cylinder bore and engine crank shaft
- 1. Dismantling of 4 cylinder petrol engine.
- 2. Assembling of 4 cylinder petrol engine.
- 3. Dismantling of 6 cylinder diesel engine.
- 4. Assembling of 6 cylinder diesel engine.
- 5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI & CRDI
- 6. Study of ignition system components coil, magneto and electronic ignition systems.
- 7. Study of engine cooling system components
- 8. Study of engine lubrication system components
- 9. Ovality and taper measurement of cylinder bore and comparison with standard specifications
- 10. Ovality and taper measurement of engine crank shaft and comparison with standard specification

#### 15BEAE313 COMPUTER AIDED MACHINE DRAWING LABORATORY 00 32 100

#### **Course Objectives:**

- To understand and interpret drawings of machine components.
- To acquire the ability in designing and making the assembly drawing of various components.
- To expose students todrawing of sleeve and cotter joint.
- To expose students toknuckle joint,gib and cotter joint
- To provide an overview ofdrawing of **universal coupling,screw jack.**
- To make the student acquire sound knowledge of piston and connecting rod

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Sketch the detailed drawing of sleeve and cotter joint.
- Sketch the detailed drawing of **knuckle joint**
- Sketch the detailed drawing of **gib and cotter joint.**
- Sketch the detailed drawing of **universal coupling.**
- Sketch the detailed drawing of screw jack.
- Create the assembly drawing of piston and connecting rod
- 1. Modeling of solid blocks
- 2. Modeling of V- Block , L- Block with rib
- 3. Modeling of blocks with holes
- 4. Modeling with square cut and U cut
- 5. Modeling of pistons and connecting rods
- 6. Assembly drawing of screw jack
- 7. Assembly drawing of Universal coupling
- 8. Assembly drawing of flanged coupling
- 9. Assembly drawing of knuckle joint
- 10. Modeling of valves
- 11. Modeling of crank shaft
- 12. Modeling of bumper
- 13. Modeling of frame assembly

# 15BECC351COMMUNICATION SKILLS DEVELOPMENTOBJECTIVES:

- To assist students to understand the role of thinking in all forms of communication.
- To help students with neutral accent.
- To guide students to read and comprehend articles from newspapers and magazines.
- To equip students with oral and appropriate written communication skills.
- To assist students with employability and job search skills.

# **INTENDED OUTCOMES:**

Students undergoing this course will be able to

• Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.

0021

- Write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Listen to/ view and comprehend different spoken discourses/ excerpts in different accents.
- Take national and international examination and enhance the performance at Placement Interviews.

# UNIT - I ESSENTIALS OF COMMUNICATION

Communication: Definition-Process-Scope-Types- Barriers- Dyadic Communication exercises.

# UNIT - II SPEECH PROCESS

Pronunciation - Voice quality - Vowels - Consonants - Diphthongs - Syllables - Word stress - Sentence

Stress – Pause - Intonation – Accent.

# UNIT - III ORAL COMMUNICATION

Distinguishing between Formal and Informal speech – Defining and Describing objects and people –Self Introduction – Extempore talk on a given topic - Asking questions politely, disagreeing politely in formal contexts – Speaking to a group - Giving oral presentations – Group discussion – Debates- Types of Interview.

# UNIT - IV WRITTEN COMMUNICATION

Formal Reports - Project Proposals - Book reviews - Official Correspondence - Proof Reading & Editing.

# UNIT – V ENGLISH FOR COMPETITIVE EXAMINATION

Synonyms, Antonyms –Grammar and usage – Error Identification – Reading comprehension- Verbal analogy- Verbal Test.

#### **TEXT BOOK:**

S.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO.	NAME	BOOK		PUBLICATION
1	Jane	Communication	Hoboken, N.J.: Wiley;	2009
	Summers&	Skills Handbook:	Chichester : John Wiley	
	Brett Smith	How to Succeed in	[distributor], USA.	
		Written and Oral		
		Communication		
		3rd Ed.		
1				

#### **REFERENCES:**

S.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO.	NAME	BOOK		PUBLICATION
1	Anderson, Paul	Technical	Thomson and Wadsworth	2007
	V	Communication	Publishers, USA.	
2	Barun, Mitra K	Effective Technical	Oxford University Press,	2006
		Communication – A	New Delhi.	
		Guide for Scientists		
		and Engineers		
3	Seely, John.	The Oxford Guide to	Oxford University Press,	2005
		Effective Writing and	New Delhi.	
		Speaking		

#### WEBSITES :

<u>www.learning-development.hr.toolbox.com</u> – Unit-III- Oral Communication <u>www.englishclub.com</u> - Writing/ Grammar – Unit-IV <u>www.ispeakyouspeak.blogspot.com</u>- Vocabulary Enrichment/ Speaking – Unit-II <u>www.teachertube.com</u> - Writing Technically – Unit- V <u>www.Dictionary.com</u>-Semantic / Grammar – Unit-IV & V

# 15BEAE401 APPLIED THERMODYNAMICS AND HEAT TRANSFER 3104100

#### Course Objectives:

- To impart knowledge on the fundamentalsof thermodynamics, zeroth law, first law and second law of thermodynamics.
- To study the thermodynamic properties of pure substances and its phase change processes.
- To learn the gas power cycles and properties of gas mixtures.
- To acquaint the student with the concepts of air standard performance of heat engines.
- To impart knowledge of the conduction heat transfer mechanisms.
- To learn the principles of convection and radiation.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Apply the first law of thermodynamics to closed and open systems.
- Solve the problems related to cycles and cyclic devices using the second law of thermodynamics.
- Determine the thermodynamic properties of pure substances and its phase change processes.
- Evaluate the air standard performance of heat engines.
- Apply the heat conduction equation to compute the rate of heat transfer in simple and composite systems.
- Determine the rate of heat transfer in convection mode and radiation mode

#### UNIT I GAS POWER CYCLES

Air standard cycles-Otto-Diesel-Dual-Work output, Efficiency and MEP calculations -

Comparison of the cycles with respect to compression ratio, heat addition, heat rejection, peak pressure, temperature and work output, Simple Brayton cycle.

#### UNIT II RECIPROCATING AIR COMPRESSORS & REFRIGEREATION CYCLES

Single acting and double acting air compressors, work required, effect of clearance

volume, volumetric efficiency, isothermal efficiency, free air delivery, two stage compression, condition for minimum work.

Fundamentals of refrigeration, C.O.P., reversed carnot cycle, simple vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

#### UNITIII HEAT CONDUCTION

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Use of Heislers Chart.

#### UNITIV HEAT CONVECTION

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Combined Laminar and Turbulent – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.

#### **UNITV RADIATION**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –(Descriptive study -Gas Radiation).

#### **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1	Rajput.R.K	Applied Thermodynamics	Laxmi	2009
			Publishing Co.,	
			New Delhi	
2	Holman.J.P, Souvik	Heat Transfer	McGraw –Hill	2011
	Bhattacharyya		Education	
			(India) Private	
			Limited	

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Nag.P.K	Basic and applied	McGraw –Hill	2009
		Thermodynamics	Education	
		-	(India) Private	
			Limited	
2	Nag.P.K	Heat and Mass Transfer	McGraw –Hill	2011
			Education	
			(India) Private	
			Limited	
3.	Kothandaraman.C.P	Fundamentals of Heat and	New Age	2012
		Mass Transfer	International,	
			New Delhi.	

#### 15BEAE402

#### **AUTOMOTIVE CHASSIS**

#### Course Objectives:

- To learn the design procedure of frame and springs.
- To study the design procedure of front axle and steering linkages.
- To provide knowledge on the design of clutches.
- To impart knowledge on the design of three speed and four speed gearboxes.
- To study the design of driveline components.
- To facilitate the understanding of shafts

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Design the frame and springs for automotive.
- Analyse the loads, moments and stresses at different sections of front axle.
- Design a suitable clutch for various engineering applications.
- Design the gearbox for various engineering applications.
- Design the propeller shaft to transmit required torque.
- Design the rear axle shafts

#### UNIT I INTRODUCTION

Types of chassis layout with reference to engine locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Testing of vehicle frames. Unitised frame body construction: Loads acting on vehicle frame.

#### UNIT II FRONT AXLEAND STEERING SYSTEM

Types of front axles. Construction details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in - Conditions for true rolling motion of wheels during steering, turning radius, Wheel wobble and shimmy. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts for conventional and independent suspension system. Power and power assisted steering.

#### UNITIII DRIVE LINE, REAR AXLE, FINAL DRIVE, AND DIFFERENTIAL

Effect of driving thrust and torque reactions. Hotch-kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity joints. Front wheel drive. Construction of rear axles. Types of loads acting on rear axles. Fully floating Three quarter floating and Semi floating rear axles. Rear axle housing. Construction of different types of axle housings. Multi axled vehicles. Construction details of multi drive axle vehicles. Different types of final drive. Double reduction and twin speed final drives. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock - Differential housing.

#### UNIT IV SUSPENSION SYSTEM

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension - Pneumatic suspension - Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

#### UNIT V BRAKING SYSTEM, WHEELS AND TYRES

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theory. Determination of braking torque. Brake actuating systems - Mechanical, Hydraulic and Pneumatic – Detailed study of components. Parking and engine exhaust brakes. Factors influencing brake performance. Power and power assisted brakes. Antilock Braking System (ABS).

Types of wheels - construction. Function of tyres - Solid and pneumatic Tyres. Constructional details of pneumatic tyres.

#### **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Tim Gilles	Automotive Chassis- Brakes, Steering and	Cengage Learning	2005
2.	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
3.	Reimpell.J, Stoll.H and Betzler.J.W	The Automotive Chassis: Engineering Principles	Elsevier India Pvt Ltd	2013

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Tom Birch	Automotive Braking Systems	Cengage Learning	1999
2.	Tom Birch	Automotive Chassis Systems	Cengage Learning	1999
3.	Tom Birch	Automotive Suspension and Steering Systems	Delmar Cengage Learning	1998
4.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAEInc	2001
6.	John Peter Whitehead, Donald Bastow and Geoffrey Howard	Car Suspension and Handling	SAEInc	2014

#### Course Objectives:

- To enrich the understanding of Clutch and Gear Box
- To introduce Hydrodynamic Drive
- To familiarize the students to understand Planetary Gear Boxes
- To introduce the concepts of Automatic Transmission Applications
- To provide knowledge on Hydrostatic Drive
- To provide knowledge on Electric Drive

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- To learn the detailed study of Clutch and Gear Box
- To learn the detailed study of Hydrodynamic Drive
- To learn the detailed study of Planetary Gear Boxes
- To learn the detailed study of Automatic Transmission Applications
- To learn the detailed study of Hydrostatic Drive
- To learn the detailed study of Electric Drive

#### UNIT I CLUTCH AND GEAR BOX

Requirements of transmission system. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles. Performance characteristics at different speeds. Different types of gearboxes - operation. Typical problems involving the above principles.

#### UNIT II HYDRODYNAMIC DRIVE

Fluid coupling - principle of operation, constructional details, torque capacity, performance characteristics, reduction of drag torque. Torque converter - Principle of operation, constructional details, performance characteristics, converter coupling, multistage and poly phase torque converters.

#### UNITIII AUTOMATIC TRANSMISSION

Ford –T model gearbox, Wilson gearbox, Cotal electromagnetic transmission, Automatic over drive, Hydraulic control system for automatic transmission.

#### UNIT IV AUTOMATIC TRANSMISSION APPLICATIONS

Chevrolet Turbo glide transmission, Toyota "ECT-i" Power glides Transmission (Automatic Transmission with Intelligent Electronic control system), Mercedes Benz Automatic transmission, Hydraulic actuation system for automatic transmission system.

#### UNIT V HYDROSTATIC AND ELECTRIC DRIVES

Hydrostatic drive – principle, types, advantage and limitations. Comparison of hydrostatic drive with hydrodynamic drive. Construction and working of typical Janny hydrostatic drive.

Electric drive - Principle of early and modified Ward Leonard Control system. Advantage & limitations. Performance characteristics.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAEInc	2001
2.	Heinz Heisler	Advanced Vehicle Technology	Butterworth Heinemann Publishers	2002

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Arthur William Judge	Modern Transmission systems	Massachusetts Robert Bentley Inc	1969
2.	Wlliam H. Crouse, Donald L.Anglin	Automotive Transmission and Power Trains construction	McGraw Hill.	1976

#### 15BEAE404

#### OBJECTIVE

- To understand the mobility of mechanism in practice.
- To understand the mechanism for displacement, velocity and acceleration at any point in a link.
- To enrich the understanding of cam-follower principles for practical applications.
- To make the students conversant in selecting appropriate gear trains for engineering applications.
- To understand the friction concepts in machine parts and assembly.
- To give exposure to the basic components and layout of linkages in the assembly of a system.

#### OUTCOME

- Compute the mobility of mechanism in practice.
- Analyze a mechanism for displacement, velocity and acceleration at any point in a link.
- Apply cam-follower principles for practical applications.
- Select appropriate gear trains for engineering applications.
- Analyze friction concepts in machine parts and assembly.
- Understand the basic components and layout of linkages in the assembly of a system.

#### UNIT I BASICS OF MECHANISMS

Terminology and Definitions–Degree of Freedom – Mobility–Kutzbach criterion–Grashoff's law–Kinematic Inversions of 4–bar chain and slider crank –Mechanical Advantage–Transmission angle–Description of common Mechanisms–Single, double and offset slider mechanisms – Quick return mechanisms – Ratchets and escapements – Indexing Mechanisms – Rocking Mechanisms – Straight line generators–Design of Crank–rocker Mechanisms.

#### UNIT II KINEMATICS

Displacement, velocity and acceleration – analysis in simple mechanisms – Graphical Method –velocity and acceleration polygons – Kinematic analysis by Complex Algebra methods–Vector Approach, Computer applications in the kinematic analysis of simple mechanisms– Instantaneous center – Coriolis Acceleration.

#### UNIT III KINEMATICS OF CAM

Classifications – Displacement diagrams–parabolic, Simple harmonic and Cycloidal motions – Layout of plate cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams – Standard cam motion – Pressure angle and undercutting.

#### UNIT IV GEARS

Spur gear Terminology and definitions–Fundamental Law of toothed gearing and involute gearing– Interchangeable gears–gear tooth action – Terminology – Interference and undercutting–Non standard gear teeth– Helical, Bevel, Worm, Rack and Pinion gears (Basics only)–Gear trains–Parallel axis gear trains– Epicyclic gear trains–Differentials

#### UNIT V FRICTION

Surface contacts–Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives, Friction aspects in Brakes – Friction in vehicle propulsion and braking.

# **TEXT BOOKS:**

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1	Rattan	Theory of Machines	Tata McGraw–Hill Education	2009
2	Joseph Shigely, John Uicker, Gordon Pennock	Theory of Machines and Mechanisms	Oxford University Press	2010

#### **REFERENCES:**

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1	Thomas Bevan	Theory of Machines	CBS Publishers	2005
2	Amitabha Ghosh and Asok Kumar Mallik	Theory of Mechanisms and Machines	EastWest Press	2006
3	Rao J.S and Dukkipati R.V	Mechanism and Machine Theory	New Age International (P) Ltd	2006

# **STANDARDS**:

- IS 2458 : 2001, Vocabulary of Gear Terms Definitions Related to Geometry
- IS 3756 : 2002, Method of Gear correction Addendum modification for External Cylindrical Gears with Parallel Axes.
- IS 5267 : 2002 Vocabulary of Gear Terms Definitions Related to Worm Gear Geometry.
- IS 12328 : Part 1: 1988 Bevel Gear Systems Part 1 Straight Bevel Gears.
- IS 12328 : Part 2: 1988 Bevel Gear Systems Part 2 Spiral Bevel Gears

#### Course Objectives:

- To enrich the understanding of fluid properties
- To make the students conversant with types of flow and calculate Major and minor loses in pipes.
- To acquaint the student with the concepts of Buckingham's  $\pi$  theorem.
- To explain the working of different pumps
- To explain the working of different turbines.
- To equip students with skills to produce analytical solutions to various simple problems

#### Course Outcomes:

On completion of the course students will be able to

- Demonstrate basic knowledge of fluid properties
- Find types of flow and calculate Major and minor loses in pipes.
- Apply Buckingham's  $\pi$  theorem for problem solving.
- Understand the working of different pumps
- Understand the working of different turbines.
- Produce analytical solutions to various simple problems

#### UNIT I BASIC CONCEPTS AND PROPERTIES OF FLUIDS

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by U Tube Manometer manometers.

#### UNIT II FLIUD KINEMATICS AND FLUID DYNAMICS

Fluid Kinematics - Flow visualization - lines of flow - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- Equation of streamline - stream function - velocity potential function - circulation - flow net - Bernoulli's equation - applications - Venturi meter, Orifice meter, Pitot tube.

#### UNITIII INCOMPRESSIBLE FLUID FLOW

Viscous flow - Navier - Stoke's equation - flow through pipes - Darcy - weisback's equation - pipe roughness -friction factor - flow through pipes in series and in parallel - power transmission - Introduction to the concept of Boundary layer flows, boundary layer thickness, boundary layer separation ,drag and lift coefficients.

#### UNIT IV HYDRAULIC TURBINES

Fluid machines: definition and classification - exchange of energy - Hydro turbines: definition and classifications of turbines- Pelton turbine velocity triangles - work done - specific speed - efficiencies - performance curve for turbines.

#### UNIT V HYDRAULIC PUMPS

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves. Introduction to reciprocating pump- single acting and double acting.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dr.R.K.Bansal	A Textbook of Fluid	Laxmi publications	2010
		Mechanics and Hydraulics	(P) Ltd, New Delhi	
		Machines		
2.	Kumar.K.L,	Engineering Fluid	S.Chand	2010
		Mechanics	Publication	
3.	Vasandani.V.P	Theory and Design of	Khanna Publishers,	2010
		Hydraulic Machines	New Delhi.	
		including Basic Fluid		
		Mechanics		
4.	Yunus A.Cengel,	Fluid Mechanics –	McGraw Hill	2013
	John M.Cimbala	Fundamentals and	Education	
		Applications		

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Victor Lyle	Fluid Mechanics	WCB/McGraw-	1998
	Streeter, E.		Hill	
	Benjamin Wylie			
	and Keith			
	W.Bedford			
2.	Frank M.White	Fluid Mechanics	McGraw-Hill	2011
			Higher	
			Education	
3.	Ramamrutham.S	Hydraulic Fluid Mechanics	Dhanpat Rai and	2004
		and Fluid Machines	Sons, New Delhi	
4.	S.Som, Gautam	Introduction to fluid	McGraw-Hill	2011
	Biswas and S.	mechanics and fluid machines	Education	
	Chakraborty		(India) Private	
			Limited	

# 15BEAE406 ENGINEERING MATERIALS AND METALLURGY3 0 0 3 100

#### Course Objectives:

- To provide knowledge on physical metallurgy of metals through the study of phase diagrams.
- To study the properties and applications of various metals and alloys used in engineering industries.
- To expose the various heat treatment processes of steels.
- To impart knowledge of the mechanical properties evaluation and testing methods of engineering materials.
- To introduce fundamentals of composites
- To provide fundamental knowledge of composites and their applications.

#### Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Explain the phase diagrams of different engineering materials.
- Recognise the properties and applications of various metals and alloys.
- Identify the appropriate heat treatment processes for the given applications.
- Test the mechanical properties of the given materials for real-time applications.
- Understand the fundamentals of composites
- Identify the appropriate composites for applications in the automotive industry.

#### **Review (Not for Exam):**

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

# UNIT I CONSITITUION OF ALLOYS AND PHASE DIAGRAMS

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

#### UNITII FERROUS AND NON FERROUS METALS

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA - maraging steels – Gray, White malleable, spheroidal -Graphite - alloy cast irons.

Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys.

# UNITIII INTRODUCTION TO COMPOSITES

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

#### UNIT IV HEAT TREATMENT

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram

CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

# UNITV MECHANICAL PROPERTIES AND TESTING

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creeptest.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Kenneth	Engineering	Prentice-Hall of	2010
	G.Budinski and	Materials:Properties and	India Private	
	Michael	Selection	Limited.	
	K.Budinski			
2.	Raghavan.V	Materials Science and	Phi Learning	2013
		Engineering		

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William D.Callister	Materials Science and	John Wiley and	2010
	and David	Engineering: An	Sons Inc, New	
	G.Rethwisch	Introduction	York	
2.	Sydney H.Avner	Introduction to Physical	McGraw-Hill	1997
		Metallurgy	Education	
			(India) Private	
			Limited.	

#### 15BEAE411 FLUID MECHANICS AND MACHINERY LAB 0 0 3 2 100

#### **Course Objectives:**

- To supplement the theoretical knowledge gained in Fluid Mechanics and Machinery with practical testing
  - To understand the concepts of coefficient of discharge for Orifice meter and Venturi meter.
- To explain the Calibration of Rotameter.
- To understand the importance of friction factor for flow through pipes.
- To impart knowledge on the performance of various pumps.
- To impart knowledge on the performance of turbines

#### **Course Outcomes:**

- Calculate the coefficient of discharge for Orifice meter and Venturimeter.
- Calibrate the Rotameter
- Estimate the friction factor for flow through pipes.
- Asses the performance of centrifugal pump and submergible pump.
- Asses the performance of reciprocating pump and gear pump.
- Asses the performance of turbines

#### LIST OF EXPERIMENTS

- 1. Determination of the Coefficient of discharge of givenVenturi meter.
- 2. Determination of the Coefficient of discharge of given Orifice meter.
- 3. Calculation of the rate of flow using Roto meter.
- 4. Determination of friction factor of given set of pipes.
- 5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submersible pump
- 6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
- 7. Conducting experiments and drawing the characteristic curves of Gear pump.
- 8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
- 9. Conducting experiments and drawing the characteristics curves of Francis turbine.
- 10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

# 15BEAE412 Course Objectives:

- To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP,BVP.
- To implement the methods using the spread sheet inExcel
- To implement solution of numerical integration
- To implement solution of initial value problems governed by ODE
- To implement solution of BVP governed by PDE
- To implement solution of transcendental equation.

#### **Course Outcomes:**

- 1. To develop analytical skills for solving different engineeringproblems.
- 2. To understand the concepts of Matrices, sequences and series.
- 3. To solve problems by applying Differential Calculus and Differentialequations.
- 4. To analysis initial value problems governed by ODE
- 5. To analysis BVP governed by PDE
- 6. To analysis transcendental equation.

# LIST OF EXPERIMENTS

- 1. Finding solution of Transcendental equation
  - i) Newton Raphson Method
  - ii) Bisection method
  - iii) Iterative method by reducing the equation to the form x = f(x)
- 2. Finding the dominant eigenvalue and eigenvector by power method
- 3. Numerical integration
  - i) Gauss 2 point and 3 point formulae
  - ii) Trapezoidal method
  - iii) Simpson's 1/3 rule
- 4. Solution of initial value problems governed by ODE
  - i) Runge Kutta 4<sup>th</sup> order method
  - ii) Modified Euler's method
  - iii) Milne's method
  - iv) Adam Bashforth method
- 5. Solution of BVP governed by PDE
  - i) Laplace Equation
  - ii) One dimensional heat equation
    - a) Explicit method : Bender Schmidt's method
    - b) Implicit method : Crank Nicolson's method
  - iii) One dimensional wave equation Implicit method
# **REFERENCES:**

S.	Author(s) Name	Title of the book	Publisher	Year of
No.				Publication
1	Steven C. Chapra,	Numerical Methods	McGraw - Hill Pub. Co. Ltd	2014
	Raymond P.	for Engineers		
	Canale			
2	Curtis F. Gerald	Applied Numerical	Pearson Education, South	2009
	and Patrick O.	Analysis	Asia	
	Wheatley	-		

## 15BEAE413AUTOMOTIVE CHASSIS AND TRANSMISSION LABORATORY 0032100

## Course Objectives:

- To expose the different types of Clutch, Gear Box, Brake system.
- To provide knowledge on Differential Unit
- To provide knowledge onPropeller Shaft Unit.
- To learn the Clutch, Gear Box, Brake system, Differential Unit
- To study the suspensionsystem.
- To impart knowledge on different Frames.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Dismantling procedure of Clutch, Gear Box, Brake system
- Dismantling procedure of Differential Unit
- Study of Propeller Shaft Unit
- Assembling procedure of Clutch, Gear Box, Brake system, Differential Unit
- Study of suspensionsystem
- Studyof different Frames

# LIST OF EXPERIMENTS

- 1. Dismantling and assembling of clutch assembly
- 2. Dismantling and assembling of gear box assembly
- 3. Dismantling and assembling of propeller shaft and universal joint assembly
- 4. Dismantling and assembling of drive shaft assembly
- 5. Dismantling and assembling of differential assembly
- 6. Dismantling and assembling of different types of rear axle floating
- 7. Dismantling and assembling of steering box assembly
- 8. Dismantling and assembling of suspension system
- 9. Dismantling and assembling of air-braking system
- 10. Dismantling and assembling of hydraulic braking system.
- 11. Bleeding of hydraulic braking system and brake adjustment
- 12. Clutch and brake pedal play adjustment
- 13. Study of Frames used for HMV, LMV, Car and Two Wheelers.

## **OBJECTIVES:**

- To help students comprehend the role of listening skills in effective communication.
- To familiarize students with verbal and non-verbal communication.
- To expose students to neutral accent.
- To develop emotional intelligence skills in them for enhancing their self-esteem.
- To assist them in setting goals and developing positive attitude.
- To enable students to acquire decision making skills, problem solving skills and assertive skills.

# **INTENDED OUTCOMES:**

Students undergoing this course will be able to

- Equip students of engineering and technology with effective speaking, writing and listening and reading skills in English.
- Develop their soft skills and inter personal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- Equip students of engineering and technology with group discussion and other recruitment exercises.
- Use both verbal and non-verbal skills cohesively and develop confidence in participating in seminars, conferences, technical and extracurricular activities for lifelong learning.

## UNIT - I THE ART OF LISTENING

The art of listening - The importance of listening - The difference between listening and hearing- Barriers to listening - Remedies for listening problems - Listening through English.

## UNIT - II VERBAL AND NON-VERBAL COMMUNICATION

Non - verbal communication - Eye contact - Facial expressions - Posture - Gestures - Body langage - Etiquette.

Verbal communication - Importance of voice modulation - Accent - Diction - Functional Grammar -Sentence construction - Effective vocabulary- Idioms- Phrases- Jargons - How to get others to listen to.

## UNIT - III INTRAPERSONAL AND INTERPERSONAL SKILLS

Intrapersonal skills - Self-analysis - Thought process -Understanding one's potential and limitations - Developing problem solving skills - Ability to self-reflect - Self-control - Improving self-esteem.

Interpersonal skills - Confidence building -Resolving conflicts - Negotiation - Handling difficult people - Valuing diversity - Adaptability and Flexibility – Inter Cultural Communication.

# UNIT - IV GOAL SETTING AND POSITIVE ATTITUDE

Difference between goals and dreams - SMART goal setting - 3 Ds of goal setting- Determination, Discipline and Direction - Developing the right attitude - Motivation - Intrinsic and Extrinsic motivation - Dealing with change - Dedication - Taking responsibilities - Decision making.

# UNIT - V MANAGERIAL SKILLS

Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Preparing résumé - Writing covering letter - Communicating via e-mail.

# **TEXT BOOK:**

S. NO.	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Gopalaswamy Ramesh & Mahadevan Ramesh	<u>The Ace of Soft</u> <u>Skills</u>	Pearson Publication, Chennai	2014

# **REFERENCES:**

<b>S.</b>	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO.	NAME	BOOK		PUBLICATION
1	Murthy, G .R. K.	Soft Skills for	The ICFAI University	2008
		Success.	Press, Hyderabad.	
2	Jagadeesan, G &	Soft Skills	The ICFAI University	2008
	Santanakrishnan,R.	Development:Training	Press, Hyderabad.	
		and		
		Evaluation.		
3	Sherfield, Robert	Developing Soft	Pearson Education,	2005
	M., Rhonda J.	Skills.	New Delhi.	
	Montgomery, &			
	Patricia G. Moody			

# WEBSITES:

<u>www.englishclub.com</u> – Art of Listening- Unit-I <u>http://tribehr.com/social-hr-software/talent-management/skills-tracking</u> - Unit-V <u>www.ispeakyouspeak.blogspot.com</u> – Unit-II https://alison.com/subjects/6/Personal-Development-Soft-Skills - Unit-III, IV,&V <u>www.learning-development.hr.toolbox.com</u> – Unit-V <u>http://www.niit.com/solution/soft-skill-training</u> - Unit-III, IV,&V

- To provide knowledge on the static and dynamic forces in various mechanisms.
- To study the features of determine the rotating masses in dynamic balancing.
- To familiarize the students to understand free and forced vibration for practical applications.
- To understand the importance torsional vibrations in mechanical components.
- To explain principles and mechanisms used for speed control and stability control.
- To impart knowledge on type of governors and gyroscopes for different applications

## Course Outcomes:

### Upon successful completion of the course, the students should be able to:

- Analyze the static and dynamic forces in various mechanisms.
- Determine the rotating masses in dynamic balancing.
- Calculate free and forced vibration for practical applications.
- Analyze torsional vibrations in mechanical components.
- Understand the principles in mechanisms used for speed control and stability control.
- Select the type of governors and gyroscopes for different applications.

## UNIT I FORCE ANALYSIS

Rigid Body dynamics in general plane motion – Equations of motion – Dynamic force analysis – Inertia force and Inertia torque – D'Alemberts principle – The principle of superposition – Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses – Bearing loads – Crank shaft Torque – Turning moment diagrams – Fly wheels –Engine shaking Forces.

### UNIT II BALANCING

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder Engine – Balancing Multi–cylinder Engines – Partial balancing in locomotive Engines – Balancing linkages – balancing machines

## UNIT III FREE VIBRATION

Basic features of vibratory systems – idealized models – Basic elements and lumping of parameters – Degrees of freedom – Single degree of freedom – Free vibration – Equations of motion – natural frequency – Types of Damping – Damped vibration critical speeds of simple shaft – Torsional systems; Natural frequency of two and three rotor systems.

## UNIT IV FORCED VIBRATION

Response to periodic forcing – Harmonic Forcing – Forcing caused by unbalance – Support motion – Force transmissibility and amplitude transmissibility – Vibration isolation.

## UNIT V MECHANISMS FOR CONTROL

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling Force – other Governor mechanisms.

Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes

## **TEXT BOOKS:**

S.N O	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1	Rattan S.S	Theory of Machines 4th Edition	Tata McGraw–Hill Publishing Company Ltd., New Delhi.	2014
2	Shigley J.E. and Uicker J.J	Theory of Machines and Mechanisms	McGraw–Hill, New York.	1995

# **REFERENCES:**

S.N O	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1	Rao J.S. and Dukkipati R.V	Mechanism and Machine Theory	Wiley– Eastern Limited, New Delhi.	2007
2	John Hannah and Stephens R.C	Mechanics of Machines	Viva Books Pvt Ltd.	2005
3	Thomas Bevan	Theory of Machines 3rd Edition	CBS Publishers and Distributors, New Delhi.	2005

- To learn the design procedure of machine elements subjected to simple loads.
- To understand the various types of stresses induced in different machine members.
- To study the design procedure of shafts and couplings.
- To provide knowledge on the design of bolted and welded joints.
- To impart knowledge on the design of helical spring and flywheel.
- To study the selection procedure of sliding and rolling contact bearings.

# Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Design machine elements subjected to simple loads.
- Design shaft for various engineering applications.
- Design couplings for various engineering applications.
- Design bolted and welded joints subjected to static and eccentric loading conditions.
- Design helical spring and flywheel for various engineering applications.
- Design and select journal bearings and rolling contact bearings for various machines.

# UNIT ISTEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – Factor of safety - theories of failure – stress concentration.

## UNIT II DESIGN OF SOLID AND HOLLOW SHAFTS

Design of solid and hollow shafts based on strength, rigidity and critical speed. Basic concepts of rigid and flexible couplings.–Introduction and concepts of keys, key ways, Knuckle joints.

## UNITIII DESIGN OF BOLTED JOINTSAND WELDED JOINTS

Design of bolted joints including eccentric loading –square threaded screws, Efficiency, Maximum efficiency.. Design of welded joints for structures -Purpose of Screw Jack, Introduction to fasteners.

# UNIT IV DESIGN OF SPUR GEARS.

Gear Terminology –Introduction to Spur gears and Helical Gears -Speed ratios and number of teeth-Force analysis - Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength.

## UNIT V DESIGN OF BEARINGS

Introduction to bearings – sliding contact and rolling contact types. – Cubic mean load – Design of Journal bearings – McKee's equation – Lubrication in journal bearings – calculation of bearing dimensions.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Juvinall.R.C and Marshek K M	Fundamentals of Machine Component	John Wiley & Sons	2011
		Design, 5 <sup>th</sup> Edition		
2.	Bhandari.V.B	Design of Machine	Tata McGraw-	2010
		Elements	Hill Book Co.	
		3rd Edition		
3.	Robert L.Mortt	Machine elements in	Macmillan	1992
		Mechanical Design	Publishing Co,	
			London	
4.	Shigley and	Mechanical Engineering	McGraw Hill,	2001
	Mischke	Design	New York.	

# REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1.	Norton.RL	Design of Machinery	Tata McGraw-	2004
			Hill Book Co.,	
			New Delhi	
2.	Orthwein .W	Machine Component	Jaico Publishing	2006
		Design	Co., New Delhi.	
3.	Ugural .A.C	Mechanical Design –	McGraw-Hill	2004
		An Integrated	Book Co,	
		Approach	New York.	
4.	Spotts.T.E,Shoup.T.H.E	Design of Machine	Pearson	2003
		Elements	Education, New	
		8th Edition	Delhi.	
5.	Maitra.G.M	Handbook of Gear	Tata McGraw	2004
		design	Hill, New Delhi	

- To impart knowledge on the mechanism of pollutant formation in engines.
- To understand the importance of post-combustion treatments to control pollution.
- To study the pollution treatment and control techniques.
- To provide knowledge on the laws and regulations related to automotive emission levels.
- To introduce properties of tyres affecting vibration and noise
- To learn the noise and vibration control techniques.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Explain the mechanism of pollutant formation in engines.
- Apply the knowledge of post-combustion treatments to control pollution.
- Discuss the control techniques and instrumentation for pollution measurements.
- State the laws and regulations related to automotive emission levels.
- Discuss the properties of tyres affecting vibration and noise
- Design the systems to reduce noise and vibration.

# UNIT I MECHANISM OF POLLUTANT FORMATION AND POST COMBUSTION TREATMENTS

Introduction, Pollutants, sources, formation of HC and CO in SI engines, NOx formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on emission formation.

Post combustion treatments: physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers

# UNIT II CONTROL TECHNIQUES AND INSTRUMENTATION FOR POLLUTION MEASUREMENTS

Crank case emission control, fuel evaporation & control, EGR, intake temp control, air injected exhaust, thermal reactors, SCR, catalytic converters – types, catalytic mechanism, tuning of mechanical systems - A/F ratio control. NDIR analyzer, flame ionization detectors, chemiliuminescent analyzer, smoke meters, gas chromatograph, On-board Diagonostic system.

## UNIT IIILAWSAND REGULATIONS

Historical background, regulatory test procedures (European cycles), exhaust gas pollutants (European railroad limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Indian Emission Standards.

## UNIT IV NOISE CONTROL

Identification of noise sources, quantification, control of air borne noise - use of noise absorber, barrier, different materials, criteria for the selection of materials, control of structure borne noise - treatments for vibration damping materials for hood liner and head liner, resonance and ill effects of resonance. Characteristics of vehicle noise, sources of vehicle noise, engine noise, techniques for locating and measuring engine noise, engine noise control techniques, inlet and exhaust noise mechanism and control, noise from cooling system, transmission noise and tyre noise. Anechoi chamber.

## UNIT V VIBRATION CONTROL

Introduction, vibration analysis, sources of vibration, damping of vibration, rubber mountings, vibration isolation and absorption. Constrained and extensive layer dampings. Engine and drivetrain vibrations, vehicle and chassis vibration. Application of plastics and composites in automobiles.

## **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Springer and Patterson	Engine Emission	Plenum Press.	1990
2.	Crouse.W.M and Anglin.A.L	Automotive emission control	McGraw Hill Co., New York	1993
3.	John B. Heywood	Internal Combustion Engine Fundamentals	McGraw Hill International Editions	2011
4.	Matthew Harrison	Vehicle Refinement – Controlling Noise and Vibration in Road Vehicles	Elsevier Butterworth- Heinemann, Burlington	2004

## REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ganesan.V	Internal Combustion Engines,4th Edition	Tata McGraw Hill Co, New Delhi	2012
2.	Obert.E.F	Internal Combustion Engines	Harper and Row, New York	1982
3.	Heinz Heisler	Advanced Engine Technology	SAE	1995
4.	Robert Hickling and Mounir M. Kamal	Engine Noise – Excitation, Vibration and Radiation	Plenum press, New York	1982
5.	White.R.G and Walker.J.G	Noise and Vibration	Ellis Horwood Ltd, England	2000

- To familiarise the concepts of measurement and characteristics of instruments.
- To learn the procedure for various linear and angular measurements.
- To provide knowledge on the measurement of gear and thread terminologies using suitable instruments.
- To expose the procedure to measure the mechanical parameters using suitable instruments.
- To study the use of laser and advances in metrology for linear geometric dimensions.
- To impart knowledge on digital devices and computer aided inspectiondevices

## Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Explain the basic concept of measurement and characteristics of measuring instruments.
- Practice the appropriate linear and angular dimensions using precision measuring instruments.
- Examine the major terminologies for the gear and screw thread measurement.
- Explain the suitable type of instrument used to measure the mechanical parameters.
- Apply the advanced techniques in metrology to calculate the geometric dimensions.
- Practice the digital devices and computer aided inspectiondevices

# UNIT I CONCEPT OF MEASUREMENT

General concept – Generalised measurement system-Units and standards-measuring instruments- sensitivity, readability, range of accuracy, precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration, interchangeability.

## UNIT II LINEAR AND ANGULAR MEASUREMENT

Definition of metrology-Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometery, optical flats, limit gauges- Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements: -Sine bar, optical bevel protractor, angle Decker – Taper measurements.

## UNITIII FORM MEASUREMENT

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish, straightness, flatness and roundness measurements.

# UNIT IV LASER AND ADVANCES IN METROLOGY

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology Coordinate measuring machine (CMM)- Constructional features – types, applications – digital devices- computer aided inspection.

## UNIT V MEASUREMENT OF POWER, FLOWAND TEMPERATURE RELATED PROPERTIES

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Flow measurement: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, pressure thermometers, thermocouples, electrical resistance thermister.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Jain.R .K	Engineering Metrology 20th Edition	Khanna Publishers, New Delhi	2004
2.	Alan S. Morris,	The Essence of Measurement	Prentice Hall of India	1997

## REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Gupta.S.K	Engineering Metrology	Dhanpat rai Publications, New Delhi	1984
2.	Jayal.A.K,	Instrumentation and Mechanical Measurements	Galgotia Publications	2000
3.	Beckwith.T.G and Lewis Buck.N	Mechanical Measurements	Addison Wesley	1991
4.	Donald D.Eckman	Industrial Instrumentation	Wiley Eastern	1985

15BEAE5E\_

# 15BEAE511THERMAL ENGINEERING LABORATORY0 0 3 2 100

## Course Objectives:

- To impart knowledge on the flash point, fire point and viscosity of the fuel.
- To learn the port timing and valve timing diagram of internal combustion engines.
- To study the performance of the internal combustion engine and refrigeration system.
- To understand the thermal conductivity, heat transfer and emissivity.
- To know the effectiveness of heat exchangers.
- To study the **coefficient of performance** of a refrigeration system

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Measure the flash point, fire point and viscosity of given sample.
- Draw the port timing diagramof two-stroke and valve timing diagram of four-stroke internal combustion engines.
- Evaluate the performance of internal combustionengine and reciprocating air compressor.
- Calculate the **coefficient of performance** of a refrigeration system.
- Estimate the thermal conductivity of material, heat transfer from surface and emissivity of a grey surface.
- Calculate the effectiveness of a heat exchanger.
- 1. Determination of Viscosity of Oils Red Wood Viscometer.
- 2. Determination of Flash Point and Fire Point of fuels
- 3. Valve timing and port timing diagram
- 4. Performance test on automotive multi-cylinder CI engines
- 5. Morse test on multi-cylinder SI engine
- 6. Thermal conductivity measurement by guarded plate method
- 7. Natural convection heat transfer from a vertical cylinder
- 8. Heat transfer from pin-fin (natural & forced convection modes)
- 9. Determination of emissivity of a grey surface
- 10. Effectiveness of Parallel/counter flow heat exchanger
- 11. Determination of COP of a refrigeration system
- 12. Performance test on single/two stage reciprocating air compressor.

# 15BEAE512 ENGINEERING METROLOGY AND MEASUREMENTS LABORATORY 0 0 3 2 100

## **Course Objectives:**

- To impart knowledge on Calibration of Vernier / Micrometer / Dial Gauge
- To introduce various measurement techniques
- To provide fundamental knowledge of dimensional tolerances
- To understand the thermal conductivity, heat transfer and emissivity.
- To know the effectiveness of straightness and flatness.
- To provide fundamental knowledge of Displacement, Force and Vibration.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Test the dimensions using Vernier / Micrometer / Dial Gauge.
- Understand the measurement techniques
- Obtain knowledge on dimensional tolerances
- Calculate the thermal conductivity, heat transfer and emissivity
- Estimate the straightness and flatness
- Obtain knowledge on measurement of displacement, Force and Vibration Displacement, Force and Vibration.

## List of Experiments:

- 1. Calibration of Vernier / Micrometer / Dial Gauge
- 2. Checking Dimensions of part using slip gauges
- 3. Measurements of Gear Tooth Dimensions
- 4. Measurement of Taper Angle using sine bar / tool makers microscope
- 5. Measurement of straightness and flatness
- 6. Measurement of thread parameters
- 7. Checking the limits of dimensional tolerances using comparators (Mechanical / pneumatic / Electrical)
- 8. Measurement of Temperature using Thermocouple / Pyrometer
- 9. Measurement of Displacement (Strain Gauge / LVDT / Wheatstone Bridge)
- 10. Measurement of Force
- 11. Measurement of Vibration / Shock

# 15BEAE513 DYNAMICS AND MECHATRONICS LABORATORY 0 0 3 2 100

## **Course Objectives:**

- To study the working principle of governor and gyroscope.
- To familiarize the students to understandgyroscopic law and gyroscopic couple
- To provide knowledge on the balancing of rotating and reciprocating masses.
- To learn the concept of transverse and torsional vibration.
- To introduce the concept and working of sensors used in the mechatronic systems.
- To impart knowledge on working of microcontroller in the mechatronic systems.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Select the suitable governor for various engineering applications.
- Familiar with gyroscopic law and determine the gyroscopic couple
- Estimate the balancing mass for rotating and reciprocating masses.
- Calculate the natural frequency of transverse and torsional vibration.
- Select the different types of sensor for various mechatronics applications.
- Develop a controller using the microcontroller for mechatronic system.

## LIST OF EXPERIMENTS

- Governors Determination of sensitivity, effort, etc. for Watt, Porter, Proell, and spring controlled Governors
- 2. Cam Determination of jump speed and profile of the cam.
- 3. Motorized Gyroscope-Verification of laws -Determination of gyroscopic couple.
- 4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
- 5. Balancing of rotating and reciprocating masses.
- 6. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
- Vibrating system spring mass system Determination of damping co–efficient of single degree of freedom system
- 8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped moment of inertia.
- 9. Transverse vibration free– Beam. Determination of natural frequency and deflection of beam.
- 10. Design and testing of fluid power circuits to control

(i)velocity (ii) direction and (iii) force of single and double acting actuators

- 11. Design of circuits with logic sequence using Electro pneumatic trainer kits.
- 12. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software

- 13. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
- 14. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW

## 15BEAE551 IN-PLANT TRAINING 110 1 100

Students will undergo industrial training for three weeks during the vacation at the end of IV semester and a report with the training completion certificate from the industry will be subsequently submitted to the department within a week after completion. Viva – Voce exam will be conducted at the end of V semester and 100 marks will be awarded.

## 3 1 0 4 100

# **IC ENGINE DESIGN**

## 15BEAE601

Course Objectives:

- To learn the design procedure of cylinder and piston.
- To study the design procedure of connecting rod.
- To provide knowledge on the design of crankshaft.
- To impart knowledge on the design of valves and valve actuating components.
- To study the design procedure of timing belt and pulley
- To acquaint the student with the concepts of sprocket and chain.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Design cylinder and piston for the specified power and torque.
- Design connecting rod of an engine.
- Design crankshaft of an engine.
- Design valves and valve actuating components.
- Select suitable timing beltand pulley.
- Select suitable transmission chains and sprockets

## UNIT I DESIGN OF CYLINDER AND PISTON

Choice of material for cylinder and piston, piston friction, piston slap, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

## UNIT II DESIGN OF CONNECTING ROD, CRANKSHAFT

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

## UNIT III DESIGN OF VALVES AND FLYWHEEL

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel.

## UNIT IVDESIGN OFVALVE ACTUATING COMPONENTS

Design of valve springs, tappet. Cam design, cam profile generation, cam shaft design, rocker and rocker shaft design considerations, materials.

## UNITV DESIGN OF BELT, PULLEY, TIMING CHAIN AND SPROCKET

Selection of V belts and pulleys – selection of Flat belts and pulleys - Selection of Transmission chains and Sprockets. Design of pulleys and sprockets

# **TEXT BOOKS:**

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	R.K. Jain	Machine Design	Khanna Publishers, New Delhi.	1997

# **REFERENCE BOOKS:**

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication	
		High Speed Compustion	Oxford-IBH		
1	P.M.Heldt	Engines	Publishing Co.,	1965	
		Lingines	Calcutta.		
2	A.Kolchin and	Design of Automotive	MIR Publishers,	1094	
2	V.Demidov	Engines	Moscow.	1964	
2	Sundanancia Munther T.V.	Maghing Degian	Khanna Publishers,	1001	
3	Sundararaja Murury 1.v.	Machine Design	New Delhi.	1991	

# **DESIGN DATA BOOK:**

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	PSG College of Technology	Design Data Book	Kalaikathir Achagam, Coimbatore.	1978

## 15BEAE602

# **VEHICLE DYNAMICS**

## **Course Objectives:**

- To study the fundamental concept of vibration of a single degree of freedom system.
- To acquire knowledge on the road vehicle dynamics, stability and handling.
- To develop an understanding of the relationships between vehicle design variables and vehicle dynamic behaviour.
- To apply modelling techniques to predict the dynamic behaviour of road vehicles.
- To introduce the concepts of gradeability, tractive force, braking force and stopping distance
- To provide knowledge onsteady state cornering model to design the steering system.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Explain the basic elements of vibration of single degree of freedom system.
- Analyse the cornering and tractive property of a tyre.
- Understand the sources of vibration
- Design and analyse the suspension system of a vehicle.
- Analyse the gradeability, tractive force, braking force and stopping distance of a vehicle.
- Apply steady state cornering model to design the steering system of a vehicle.

## UNIT I INTRODUCTION

Fundamental of vibration, Mechanical vibrating systems. Modelling and Simulation - Model of an automobile - Single, two, multi degrees of freedom systems – Free, forced and damped vibrations. Magnification factor - Transmissibility - Vibration absorber.

## UNIT II MULTI DEGREE OF FREEDOM SYSTEMS

Closed coupled system - Eigen value problems - Far coupled Systems - Orthogonality of mode shapes – Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled and branched systems.

## UNITIII SUSPENSION AND TYRES

Requirements. Sprung mass frequency. Wheel hop, wheel wobble, wheel shimmy. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and apt directions. Ride characteristics of tyre - Effect of driving and braking torque - Gough's tyre characteristics.

## UNIT IV VEHICLE HANDLING

Over steer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.

## UNIT V STABILITY OF VEHICLES

Load distribution, Calculation of Tractive effort and reactions for different drives - Stability of a vehicle on a slope, on a curve and a banked road.

## **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giri .N.K,	Automobile Mechanics 8th Edition	Khanna Publishers,New Delhi.	2008
2.	Rao.J.S and Gupta.K	Theory and Practice of Mechanical Vibrations	Wiley Eastern Ltd Delhi.	1999

# REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Heldt.P.M	Automotive Chassis	Chilton Co., New York	1992
2.	Ellis.J.R	Vehicle Dynamics	Business Books Ltd., London	1991
3.	Giles.J.G	Steering, Suspension and Tyres	llliffe Books Ltd, London	1998
4.	Gillespie.T.D	Fundamental of Vehicle Dynamics	Society of Automotive Engineers,USA	1992

- To impart knowledge on the basic principle and manufacturing methods of components.
- To study the steps involved in the casting process.
- To learn the theory of metal cutting and calculate the forces involved in it.
- To introduce the basic concepts of integrated manufacturing.
- To introduce the basic concepts of grinding process
- To provide an exhaustive knowledge on various generic process and benefits of rapid prototyping techniques.

## Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- List and explain the steps involved in the casting process.
- Understand the theory of metal cutting
- Select the suitable type of machine for machining operations.
- Describe the types of grinding process.
- Select the suitable material handling and storage system for flexible manufacturing systems.
- Select appropriate rapid prototyping process for engineering applications.

# UNIT I FOUNDRY AND CASTING

Patterns. Moulds-types of moulds, moulding sand characteristics. Core making, melting, Processes-shell moulding, investment castings, centrifugal castings, die casting, Fettling and cleaning of casting. Casting defects and remedies.

## UNIT II THEORY OF METAL CUTTING AND MACHINE TOOLS

Introduction, mechanics of metal cutting, orthogonal and oblique cutting, merchants equation, chip formation, heat generation, cutting fluids, cutting tool life - recent developments and applications (Dry machining and high speed machining).

Cutting tool materials, cutting tool nomenclature, introduction to machine tools, lathe, shaper, planning, milling, drilling and boring machines, working principle, operations, work holding devices, machining time calculation and cost estimation.

# UNIT III MANUFACTURE OF COMPONENTS AND SURFACE FINISHING PROCESSES

Production of axi-symmetrical components- shafts, hubs, pins. Production of prismatic componentshousings, lathe beds, gearboxes, machine columns. Hole production in components using drilling and boring.

Gear manufacturing processes-Gear form machining-generation process and gear hobbing, shaping machines, manufacture of spur, helical, bevel, worm and worm wheel. Gear finishing.

Surface finishing processes- Grinding machines, grinding wheel specification, honing, lapping, burnishing, super finishing surface integrity concepts.

## UNIT IV INTEGRATED MANUFACTURING SYSTEM

Definition – application – features – types of manufacturing systems – machine tools – computer control system – DNC systems manufacturing cell Flexible manufacturing systems (FMS) – The FMS concept – transfer systems – head changing FMS, Group Technology.

# UNIT V RAPID PROTOTYPING

Introduction, FDM- Principle, process parameters, applications, SLS- Types of machines, principles of operation, process parameters, applications. Rapid Tooling- Indirect rapid tooling - silicone rubber tooling, aluminum filled epoxy tooling, spray metal tooling, direct rapid tooling - direct AIM, quick cast process, copper polyamide, rapid tool.

## **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bhattacharya.A	New Technology	IN Publishing, New Delhi	1984
2.	Milton C. Shaw	Metal Cutting Principles	Clarendon Press, Oxford	1999
3.	Singh.D.K	"Manufacturing Technology	Pearson Education	2008
4.	Kalpakjian	Manufacturing Engineering and Technology, 3 <sup>rd</sup> Edition	Addison Wesley Publishing Company Inc	1995
5.	Khanna .O.P	Welding Technology	Dhanpat Rai and Sons, New Delhi.	1994
6.	DucPham and Dimov S S	Rapid manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling	Springer	2011

## REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	НМТ	Production Technology	Tata McGraw- Hill Co, New Delhi	2004
2.	James Brown	Advanced Machining Technology Handbook	McGraw Hill Book Company, New York	1998
3.	Pandey.P.C	Modern Machining Processes	Tata McGraw Hill Publications Co. Ltd, New Delhi	2013

## 15BEAE604 ENGINEERING ECONOMICS ANDFINANCIAL MANAGEMENT 3 0 0 3 100

# Course Objectives:

- To introduce the basics of economics and cost analysis related to engineering so as to take economically sound decisions.
- To acquire knowledge on laws of demand and supply.
- To emphasise the systematic evaluation of the costs, break-even point for return on economics and diseconomies.
- To acquaint in pricing methods, payback and competition in the modern market structure.
- To impart knowledge on economic liberalization, privatization and globalization
- To enrich the understanding of engineering economics analysis

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Apply the major concepts and techniques of engineering economic analysis in real-time applications.
- Analyse the demand and supply and sketch a demand and supply curve.
- Determine the break-even point and find out the strength and weakness of the market structure.
- Compare the cost of multiple projects by using the methods learned, and make a quantitative decision between alternate facilities and/or systems.
- Understand economic liberalization, privatization and globalization
- Apply the appropriate engineering economics analysis methods for problem solving.

# UNIT-I FUNDAMENTALS OFENGINEERINGECONOMICS

 $\label{eq:constraint} Introduction to Engineering Economics-Definition and Scope-Significance of Engineering Economics-Demand and supply analysis-Definition-Law of Demand-Elasticity of Demand-DemandFore casting. Supply-Law of supply-Elasticity of Supply.$ 

# UNIT-II FINANCIALMANAGEMENT

Objectives and functions of financial management – financial statements, working capital management – factors influencing working capital requirements – estimation of working capital. Capital budgeting – Needfor Capital Budgeting – Project Appraisal Methods - Payback Period – ARR – Time Value of Money.

# UNIT-III CAPITALMARKET

Stock Exchanges – Functions – Listing of Companies – Role of SEBI – CapitalMarket Reforms. Money and banking - Money – Functions –Inflation and deflation– Commercial Bank and its functions – Central bank and its functions.

# UNIT-IV NEWECONOMICENVIRONMENT

National Income – concepts – methods of calculating national income - Economic systems, Economic Liberalization – Privatization – Globalization. An overview of International Trade – World Trade Organization – Intellectual Property Rights.

## UNIT-V COST ANALYSIS AND BREAK EVEN ANALYSIS

Cost analysis - Basic cost concepts – FC, VC, TC, MC – Cost output in the short and long run. Depreciation - meaning – Causes – Methods of computing Depreciation (simple problems in Straight Line Method, Written Down Vale Method). Meaning – Break Even Analysis - Managerial uses of BEA.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ramachandra Aryasri .A and Ramana Murthy.V.V	Engineering Economics & Financial Accounting	Tata McGraw Hill, New Delhi	2004
2.	Varshney.RL and Maheshwari.K.L	Managerial Economics	Sulthan Chand & Sons, New Delhi.	2001

# REFERENCE

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Samuelson and Nordhaus	Economics	Tata McGraw Hill, New Delhi	2002

# 15BEAE6E\_DepartmentElective-II3 0 0 3 100

15BEAE6E\_Department Elective-III3 0 0 3 100

## 15BEAE611 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY 0 0 3 2 100

# Course Objectives:

- To expose the different types of batteries, starting motors and generators
- To provide knowledge on ignition system
- To provide knowledge onelectricalwiring.
- To learn the rectifiers, filters, logicgates, adder, flip-flops, SCR and IC timer
- To study the microcontrollers.
- To impart knowledge on automotive lightingsystem.

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Understand different types of batteries, starting motors and generators
- Describe the ignition system
- Study of electrical wiring.
- Study of rectifiers, filters, logicgates, adder, flip-flops, SCR and IC timer
- Obtain knowledge onmicrocontrollers
- Obtain knowledge onautomotive lightingsystem

# List of Experiments:

# A. Electrical Laboratory

- 1. Testing of batteries and battery maintenance
- 2. Testing of starting motors and generators
- 3. Testing of alternators
- 4. Diagnosis of ignition system faults
- 5. Study of Automobile electrical wiring
- B. Electronics Laboratory
- 6. Study of rectifiers and filters
- 7. Study of logic gates, adder and flip-flops
- 8. Study of SCR and IC timer
- 9. Interfacing A/D converter and simple data acquisition
- 10. Micro controller programming and interfacing
  - -Display interface using microcontroller.
  - -Keyboard interface using microcontroller.
  - -Sensor interface using microcontroller.
  - -Stepper motor interface using microcontroller.
  - -DC motor interface using microcontroller.
  - Simulation of automotive lighting system.

- To facilitate the understanding of lathe machine and its operations.
- To provide practical knowledge on Preparing a flat and contour surface using milling machine.
- To provide practical knowledge on Preparing holes with higher finish by Drilling / Tapping / Reaming.
- To facilitate the understanding of surface and cylindrical grinding operations for surface finish.
- To introduce Surface preparation and etching techniques, heat treatment and metallographic studies.
- To impart knowledge on Forging processes.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Perform various operations on of lathe machine.
- Prepare a flat and contour surface using milling machine.
- Prepare holes with higher finish by Drilling / Tapping / Reaming.
- Perform surface and cylindrical grinding operations for surface finish.
- Prepare Surface preparation and etching techniques, heat treatment and metallographic studies..
- Perform various Forging processes.

## List of Experiments:

1. Introduction- lathe machine, plain turning, Step turning & grooving (Including lathe mechanisms, simple problems).

2. Taper turning-compound rest/offset method & Drilling using lathe (Including Drilling feed mechanism, Twist drill nomenclature, and Different types of taper turning operations).

- 3. External threading-Single start (Including Thread cutting mechanism-simple problems)
- 4. Eccentric turning-Single axis
- 5. Shaping-V-Block (Including Shaper quick return mechanism)
- 6. Grinding-Cylindrical /Surface/Tool & cutter
- 7. Slotting-Keyways (Including Broaching tool nomenclature and Slotter mechanism)
- 8. Milling-Polygon /Spur gear (Including Milling mechanism, simple problems)
- 9. Gear hobbing-Helical gear
- 10. Drilling, reaming, counter boring
- 11. Planning/Capstan lathe/Burnishing process (Planner Mechanism, Description of capstan and turret lathe)
- 12. Surface preparation and etching techniques, heat treatment and metallographic studies.
- 14. Laboratory experiments in fabrication processes: Spot, MIG, ARC and Gas Welding, Testing of Joints.
- 14. Basic Forging processes like upsetting, drawing down and forge welding

## 15BEAE651

## MINI PROJECT 0 0 21100

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

## The mini-project involves the following:

- Preparing a project brief proposal including
- Problem identification
- -A statement of system / process specification proposed to be developed (Block diagram / concept tree)
- -List of possible solutions including alternative and constraints

-Cost benefit analysis

-Time Line of activities

-A report highlighting the design finalization (based on functional requirements

& standards)

- Fabrication
- Testing & Validation of the developed system
- Learning in the Project
- Consolidated report preparation

# 15BEAE652 VALUE ADDED COURSE I

18

- To impart basic knowledge on the finite element method.
- To provide knowledge on one- and two-dimensional elements.
- To study heat conduction problems using finite element method.
- To present knowledge on the higher order and isoparametric elements.
- To Study and acquire knowledge on numerical methods
- To provide knowledge on Gaussian quadrature method

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Apply the numerical methods to formulate the simple finite element problems.
- Apply the one-dimensional finite element method to solve bar, beam and truss type problems.
- Apply the finite element method for plane stress, plane strain and axisymmetric conditions.
- Determine the temperature distribution of one and two dimensional heat transfer problems using one and two dimensional finite elements.
- Apply the numerical methods to formulate the higher order and isoperimetric problems.
- Apply Gaussian quadrature method.

# UNIT I INTRODUCTION

Historical background – Matrix approach – Application to the continuum – Discretization – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method

# UNIT II ONE DIMENSIONAL PROBLEMS

Finite element modeling – Coordinates and shape functions– Potential energy approach – Galerkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

## UNIT III TWO DIMENSIONAL CONTINUUM

Introduction – Finite element modeling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galerkin approach – Stress calculation – Temperature effects

# UNIT IV AXISYMMETRIC CONTINUUM

Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs

# UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

# **TEXT BOOKS:**

S.N O	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1	Rao S.S	The Finite Element Method in Engineering 5th Edition	Butter worth Heinemann imprint, USA	2010
2	Logan D.L	A First course in the Finite Element Method 5th Edition	Cengage Learning, Stamford, USA.	2012

# **REFERENCES:**

S.NO	AUTHOR(S) NAME	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1	Chandrupatla T.R., and Belegundu A.D	Introduction to Finite Elements in Engineering	Pearson Education, Delhi.	2002
2	David V Hutton	Fundamentals of Finite Element Analysis	McGraw–Hill Int. Ed, New York.	2005

- To study the fundamental concept of vibration Automobile Design..
- To acquire knowledge on Vehicle Motion.
- To develop an understanding of Performance Curves
- To apply modelling techniques to predict Vehicle Frame and Suspension.
- To introduce Front Axle and Steering Systems
- To provide knowledge on Final Drive and Rear Axle.

## Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Explain the basic elements of Automobile Design.
- Analyse the Vehicle Motion.
- Understand the Performance Curves
- Design and analyse the Vehicle Frame and Suspension.
- Understand the Front Axle and Steering Systems of a vehicle.
- Knowledge on Final Drive and Rear Axle

# UNIT I INTRODUCTION

Assumptions to be made in designing a vehicle, Range of values for Gross Vehicle Weight, Frontal Area, maximum speed, maximum acceleration, gradability in different gears, Basics of Automobile Design.

# **UNIT IIVEHICLE MOTION & PERFORMANCE CURVES**

Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation. Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different\vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

# UNIT - III VEHICLE FRAME AND SUSPENSION

Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

# UNIT – IV FRONT AXLEAND STEERING SYSTEMS

Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

# UNIT – V FINAL DRIVE AND REAR AXLE

Design of propeller shaft, design details of final drive gearing, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giri.N.K	Automobile Mechanics	Khanna	2008
		8th Edition	Publishers, New	
			Delhi.	
2.	Prabhu.T.J	Design of Transmission	P R	2003
		Elements	Lithographers	
3.	Lichty	IC Engines	Kogakusha Co.,	1986
			Limited, Tokyo.	
4.	Julien Happian-Smith	An Introduction to Modern	Butterworth	2000
		Vehicle Design	Heinemann	
			Publishers	

# REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Giles.J.G	Engine Design	lliffe Books Ltd., London	1968
2.	John Fenton	Gasoline Engine analysis for CAD	MEP, London.	1986
3.	Fred Schaefer and Richard Van Basshuysen	Internal Combustion Engine Handbook-Basic Components, Systems and Perspectives	SAE.	2004
4.	Heldt P M	High Speed Combustion Engines	Oxford IBH Publishing Co., Calcutta	1986
15BEAE7E\_

# 15BEAE711AUTOMOBILE VEHICLE MAINTENANCE AND RE-CONDITIONING<br/>LABORATORY0 0 3 2 100

## Course Objectives:

- To study the garage layout and general procedure for servicing.
- To learn the tuning of gasolineengine.
- To expose students to tuning of diesel engines
- To impart knowledge on fault diagnosis in electrical and electronic ignition systems.
- To provide knowledge on troubleshooting of fuel feed system, charging system, starting system and lighting system.
- To familiarise with adjustment of the headlight beam.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- List the procedure for servicing of an automobile.
- Demonstrate the tuning of gasoline engines.
- Demonstrate the tuning of diesel engines.
- Identify the fault in electrical and electronic ignition systems.
- Analyse and troubleshoot the faults of fuel feed system, charging system, starting system and lighting system.
- Demonstrate the adjustment of the headlight beam.

## List of Experiments:

## I AUTOMOBILE VEHICLE MAINTENANCE

1.Study and layout of an automobile repair, service and maintenance shop.

2. Study and preparation of different types of tools and instruments, different statements/records required for the repair and maintenance works

3. Minor and major tune up of gasoline and diesel engines

4. Fault diagnosis in electrical and electronic ignition systems

5. Gasoline fuel system, diesel fuel system and rectification

6. Study of faults in the electrical systems such as Head lights, Side of Parking lights, Trafficator lights, Electric horn system, Windscreen wiper system, Starter system and charging system.

7. Study of fuel filters (both gasoline and diesel engines) and air cleaners (dry and wet)

8. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.

9. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play

10. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.

11. Adjustment of head lights beam.

## **II AUTOMOBILE RE-CONDITIONING**

- 12. Removal and fitting of tire and tube.
- 14. Cylinder reboring checking the cylinder bore.
- 14. Setting the tool and reboring.
- 15. Valve grinding, valve lapping.
- 16. Setting the valve angle and checking for valve leakage
- 17. Calibration of fuel injection pump
- 18. Chassis alignment testing

## 15BEAE712 AUTO SCANNING AND VEHICLE TESTING LABORATORY

## 0032 100

## **Course Objectives:**

- To introduce knowledge of Computerized engine analyzer.
- To provide knowledge on wheelbalancing.
- To impart knowledge on wheelalignment.
- To learn about Head light focusingtest.
- To impart knowledge on emission test
- To expose students toBrakingdistancetestandVisibilitytest

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Analysis of engine using Computerized engine analyzer.
- Perform wheelbalancing.
- Perform wheelalignment.
- Understand Head light focusingtest
- Perform emission test.
- PerformBrakingdistancetestandVisibilitytest
- 1. Computerized engine analyzer study and practice;
- 2. Computerized wheel balancing machine study and practice:
- 3. Computerized wheel alignment machine study and practice;
- 4. Head light focusing test;
- Exhaust emission test of petrol and diesel engine; Study of NDIR Gas Analyser and FID.
  Study of Chemiluminescent NOx analyzer. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer. Diesel smoke measurement.
- 6. Braking distance test and Visibility test.

## 15BEAE713 COMPUTER AIDED DESIGN ANALYSIS LABORATORY0 0 3 2 100

#### **Course Objectives:**

- To introduce knowledge of the FEA software as a tool for analysis.
- To provide knowledge on contact stress analysis using FEA software.
- To impart knowledge on transient analysis using FEA software.
- To learn about temperature distribution for heat conduction using FEA software.
- To impart knowledge on coupled field analysis using FEA software.
- To expose students to analysis of the simple structure using FEA software

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Analysis of piston and connecting rod using FEA software.
- Analysis of bumper using FEA software.
- Analysis of leaf spring using FEA software.
- Analysis of composite structure using FEA software
- Find the temperature distribution for heat conduction using FEA software.
- Dynamic analysis of the simple structure using FEA software.
- 1. Transient analysis of connecting rod.
- 2. Crash analysis of bumper.
- 3. Thermal analysis of piston.
- 4. Contact stress analysis of leaf spring.
- 5. Coupled field analysis of brake shoes.
- 6. Study of Combustion analysis.
- 7. Study of Aerodynamic analysis.
- 8. Contact stress analysis of gear pair.
- 9. Stress analysis of composite structure.
- 10. Vibration analysis of quarter car model.

#### LIST OF EQUIPMENTS

(for a batch of 30 students)

- 1. Computer system 30 Nos.
- 2. Software like Pro-E 15 licenses.
- 3. ANSYS Software 15 licenses.

## 15BEAE751 VALUE ADDED COURSE II11 0 1 100

15BEAE801

#### Course Objectives:

- To learn concepts, dimension quality and philosophies of TQM.
- To study the TQM principles and its strategies.
- To expose the seven statistical quality and management tools.
- To impart knowledge on TQM tools for continuous improvement.
- To introduce the quality systems and procedures adopted.
- To acquaint the student with the concepts of quality management system

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Use the concepts, dimension of quality and philosophies of TQM.
- Apply the principles of TQM and its strategies in industries.
- Apply the statistical quality tools and seven management tools.
- Choose suitable TQM tools for continuous improvement.
- Understand the Failure Modes and Effects Analysis
- Use the concepts of quality management system in industries.

#### UNIT I INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

#### UNIT II TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Emplowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

#### UNITIIISTATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

#### UNIT IV TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

## UNIT V QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

## **TEXT BOOK**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Dale H.Besterfiled	Total Quality Management	Pearson Education, Inc.	2011

#### REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	James R.Evans and William M.Lindsay	The Management and Control of Quality	South Western College	2010
2.	Feigenbaum.A.V,	Total Quality Control	McGraw-Hill Professional	2004
3.	Oakland.J.S	Total Quality Management and Operational Excellence	Routledge	2014
4.	Narayana.V and Sreenivasan.N.S	Quality Management – Concepts and Tasks	New Age International Ltd., New Delhi.	1996

#### 15BEAE891

#### PROJECTWORK

#### **OBJECTIVE**

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

#### 15BEAE5E1

## **COMPOSITE MATERIALS**

## **COURSE OBJECTIVES**

- 1. To understand the fundamentals of composite material strength and its mechanicalbehavior
- 2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of thefiber.
- 3. Thermo-mechanical behavior and study of residual stresses in Laminates duringprocessing.
- 4. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronicchips.
- 5. Impart knowledge on carbon-carbon composite
- 6. Impart knowledge on advances incomposites

## **COURSE OUTCOMES**

Learners should be able to

- 1. Select the various types of composite matrix required for anapplication.
- 2. Choose appropriate manufacturing process for polymer matrix composite.
- 3. Opt appropriate manufacturing process for metal matrixcomposite.
- 4. Use the concepts of ceramic composites and its productiontechniques.
- 5. Identify the type of carbon-carbon composite for different industrial application.
- 6. Explain the various advances incomposites

## UNIT I INTRODUCTION TO COMPOSITES

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

## UNIT II POLYMER MATRIX COMPOSITES

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

## UNITIII METAL MATRIX COMPOSITES

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

## UNIT IV CERAMIC MATRIX COMPOSITES

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

## UNIT V ADVANCES IN COMPOSITES

Carbon /carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

## TEXT BOOKS

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Mathews.F.L, and	Composite	Chapman and	1994.
	Rawlings.R.D	materials:	Hall, London,	
		Engineering and	England.	
		Science, 1 <sup>st</sup>		
		edition		
2.	Chawla.K.K	Composite	Springer –	2012
		materialsScience	Verlag.	
		& Engineering		

## REFERENCES

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Clyne.T.W and Withers.P.J	Introduction to	Cambridge	1995
		Metal Matrix	University Press.	
		Composites		
2.	Strong.A.B	Fundamentals of	SME	1989
		Composite		
		Manufacturing		
3.	Sharma.S.C	Composite	Narosa	2000
		materials	Publications,	
			New Delhi.	

## 15BEAE5E2 SPECIAL VEHICLES 3003100

#### **Course Objectives:**

- To impart knowledge of the construction layout and applications of the off-road vehicles.
- To learn the variousearth moving constructional machines.
- To study the construction and working details of industrial vehicles.
- To acquire knowledge on the working of tractor attachments and military vehicles.
- To provide knowledge on the mechanism of brake, suspension and steering in off-road vehicles.
- To impart knowledge on earth moving machines

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Explain the construction layout and features of off-road vehicles.
- Select earth moving constructional machine for a particular application.
- Describe the construction details and working of industrial vehicles.
- State the special features of tractor attachments and military vehicles.
- Illustrate the mechanism of brake
- Illustrate the mechanism of suspension and steering

#### UNIT I EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS

Construction layout, capacity and applications of earthmovers for dumpers, front-endloaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders etc.criteria for selection of prime mover fro dumpers and front end loaders based onvehicle performance characteristics.

## UNIT II POWER TRAIN CONCEPTS

Engine – converter match curves. Epicyclic type transmissions. Selection criteria foruniversal joints. Constructional details of steerable and drive axles of dumper.

#### UNIT III VEHICLE SYSTEMS, FEATURES

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist andbucket operational hydraulics. Hydro-pneumatic suspension cylinders. Powersteering system. Kinematics for loader and bulldozer operational linkages. Safetyfeatures, safe warning system for dumper. Design aspects on dumper body, loaderbucket and water tank of sprinkler. Articulated vehicles, double decker. Fire fightingequipment.

## UNIT IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS

Constructional features, capacity and stability of jib cranes. Vibratory compactors.Stackers, borewell machines, concrete mixtures.

## UNIT V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles. Harvesting vehicles.

## **TEXT BOOKS:**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Pipenger.	Industrial Hydraulics.	Mcgraw Hill, Tokoyo.	1979.
2.	A. Astakhov.	Truck cranes.	MIR Publishers, Moscow.	1971.
3.	Bart H Vanderveen.	Tanks and Transport Vehicles.	Frederic Warne and co. Ltd., London.	1974.
4.	K. Abrosimov, A. Bromberg and F. Katayer.	Road making machineries.	MIR Publisher, Moscow.	1975.
5.	SAE Handbook – V	ol III, 1995.		

## 15BEAE5E3TRACTOR ANDFARM EQUIPMENTS3 0 0 3 100

#### Course Objectives:

- To familiarise the components of a tractor and its controls.
- To impart knowledge on the various farm equipment.
- To expose students to the types of tractors.
- To familiarize the students to understand the performance characteristics of a tractor engine.
- To facilitate the understanding of cooling and lubrication system for troubleshooting.
- To impart knowledge on tractorattachments

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Classify the types of tractors.
- Explain the performance characteristics of a tractor engine.
- Discuss the construction and operation of the valve mechanism.
- Analyse the cooling and lubrication system for troubleshooting.
- Discuss the tractorattachments
- List and explain the various farm equipment.

#### UNIT I GENERAL DESIGN OF TRACTORS

Classification of tractors - Main components of tractor - Safety rules.

## UNIT II CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION

Tractor controls and the starting of the tractor engines - Basic notions and definition - Engine cycles – Operation of multi cylinder engines - General engine design - Basic engine performance characteristics.

#### UNITIII ENGINE FRAME WORKAND VALVE MECHANISM OF TRACTOR

Cylinder and pistons - Connecting rods and crankshafts - Engine balancing - Construction and operation of the valve mechanism - Valve mechanism components - Valve mechanism troubles.

#### UNIT IV COOLING SYSTEM, LUBRICATION SYSTEM ANDFUEL SYSTEM

Cooling system - Classification - Liquid cooling system - Components, Lubricating system servicing and troubles -Fuel tanks and filters - Fuel pumps- Air cleaner and turbo charger

#### UNIT V FARM EQUIPMENTS

Working attachment of tractors - Farm equipment - Classification - Auxiliary equipment - Trailers and body tipping mechanism.

## **REFERENCE BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Rodichev and Rodicheva.G	Tractor and	MIR	1987
		Automobiles	Publishers.	
2.	Kolchin.A and Demidov.V	Design of	MIR	1984
		Automotive engines	Publishers.	
		for tractor		

## 15BEAE5E4 OFF ROAD VEHICLES

#### **Course Objectives:**

- To impart knowledge of the construction layout and applications of the off-road vehicles.
- To learn the variousearth moving constructional machines.
- To study the construction and working details of industrial vehicles.
- To acquire knowledge on the working of tractor attachments and military vehicles.
- To provide knowledge on the mechanism of brake, suspension and steering in off-road vehicles.
- To impart knowledge on earth moving machines

#### Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Explain the construction layout and features of off-road vehicles.
- Select earth moving constructional machine for a particular application.
- Describe the construction details and working of industrial vehicles.
- State the special features of tractor attachments and military vehicles.
- Illustrate the mechanism of brake
- Illustrate the mechanism of suspension and steering

## UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES

Power plants, chassis and transmission, Multi axle vehicles.

## UNIT II LAND CLEARING MACHINES

Bush cutter, Stampers, Tree dozer, Rippers.

## UNITIII EARTH MOVING MACHINES

Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

## UNIT IV SCRAPERS AND GRADERS

Scrapers, elevating graders, self powered scrapers and graders.

## UNIT V SHOVELS AND DITCHERS

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

## **REFERENCE BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Abrosimov.K, Bryan berg.A	Road making	MIR Publishers,	1971
	and Katayer.K	Machinary	Moscow.	
2.	Wong.J.Y	Theory of	John Wiley &	2008
		Ground vehicles	Sons, New York	

#### Course Objectives:

- To impart knowledge of the construction layout and applications of the off-road vehicles.
- To learn the variousearth moving constructional machines.
- To study the construction and working details of industrial vehicles.
- To acquire knowledge on the working of tractor attachments and military vehicles.
- To provide knowledge on the mechanism of brake, suspension and steering in off-road vehicles.
- To impart knowledge on earth moving machines

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Explain the construction layout and features of off-road vehicles.
- Select earth moving constructional machine for a particular application.
- Describe the construction details and working of industrial vehicles.
- State the special features of tractor attachments and military vehicles.
- Illustrate the mechanism of brake
- Illustrate the mechanism of suspension and steering

## UNIT I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

## UNIT II POWER PLANT REPAIR AND OVERHAULING

Dismantling of power plant and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system,- lubrication system. Power plant trouble shooting chart.

#### UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems. Tyre maintenance.

## UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste.

## UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS

Care, maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

## **TEXT BOOKS:**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	A.W.Judge.	Motor Vehicle Servicing.	3rd Edition, Pitman Paperpack, London.	1969.
2.	W.Crouse.	Everyday Automobile repair.	Intl.student edition, TMH, New Delhi.	1986.
3.	Ernest Venk., Edward spicer.	Automotive maintenance and trouble shooting.	D.B. Taraporevala Sons, Bombay.	1963.

## **REFERENCES:**

SL.NO.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1.	Stator Abbey.	Automotive steering,	pitman	1971.
		braking and	publishing, London.	
		suspension overhaul.		
2.	Frazee, fledell,	Automobile collision	American technical	1953.
	Spicer.	Work.	publications,	
			Chicago.	
			_	
3.	John Dolce.	Fleet maintenance.	Mcgraw Hill,	1984.
			Newyork.	
4.	A,W.Judge.	Maintenance of high	Chapman Hall Ltd.,	1956.
		speed diesel engines.	London.	
5.	V.L.Maleev.	Diesel Engine	McGraw Hill Book	1995.
		operation and	CO., Newyork	
		maintenance.		

## 15BEAE6E1 DESIGN FOR MANUFACTURE AND ASSEMBLY 3 0 0 3 100

#### Course Objectives:

- To introduce the way of specifying dimension and tolerance in engineering drawing by using geometric dimensioning and tolerancing.
- To indicate the design considerations while casting, welding and forming of components.
- To familiarise with the concept and design guidelines for manufacturing parts by different machining processes.
- To study the factors affecting the easy assembly of parts into a final product.
- To impart knowledge on the environmental impact of products manufactured and engineering ways to minimise it
- To Study and acquire knowledge on disassembly, recyclability, remanufacture

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Apply geometric dimensioning and tolerancing techniques in engineering drawing.
- Apply design considerations to minimise the difficulty in fabrication of components by casting, welding and forming processes.
- Apply design for manufacturing concept to reduce the machining time and manufacturing cost.
- Perform the parts assembly of the given component using design for assembly guidelines.
- Design components taking into consideration the environmental impact.
- Describedisassembly, recyclability, remanufacture,

## UNIT I

## DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY

DFM approach, DFM guidelines, standardization, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka - Yoke principle;  $6\sigma$  concept; design creativity.

Tolerance Analysis: Process capability, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

## UNIT II SELECTIVE ASSEMBLY

Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples.

Datum Systems: Degrees of freedom, grouped datum systems-different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, grouped datum system with spigot and recess pair and tongue-slot pair, computation of translational and rotational accuracy, geometric analysis and applications.

## UNITIII TRUE POSITION TOLERANCING THEORY

Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.

## UNIT IV FORM DESIGN OF CASTINGS AND WELDMENTS

Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – design considerations for plastic component manufacturing.

Tolerance Charting Technique: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining, datum features - functional and manufacturing, component design-machining considerations, redesign for manufacture, examples.

## UNIT V LEAN MANUFACTURING

Need for lean concepts, different types of waste, metrics of manufacturing, an overview of value stream mapping- present state map, future state map, evaluation of benefits – Process FMEA, Design FMEA

#### **TEXT BOOKS**

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1	Harry Peck,	Designing for	Pitman Publications,	1983
		Manufacture	London	
2	Robert Matousek	Engineering Design a	Blackie and Son	1974
	D C Johnson	Systematic Approach	Ltd., London.	

#### REFERENCES

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Spotts.M.F	Dimensioning and Tolerance for Quantity Production	Prentice Hall Inc., New Jersey, USA.	1983
2	Oliver R Wade	Tolerance Control in Design and Manufacturing	Industrial Press Inc., New York.	1967
3	James G.Bralla	HandBook of Product Design for Manufacturing	McGraw Hill Publications, New Delhi.	1983

## Course Objectives:

- To formulate design optimization problems for engineering applications.
- To provide knowledge on single variable unconstrained problems.
- To learn multi-objective unconstrained optimization problems.
- To introduce concepts of constrained non-linear optimization problems.
- To interpret non-traditional optimization techniques for engineering problems.
- To study the features of neural network-based optimization

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Formulate design optimization problem from real-world applications.
- Compute the solution for single variable unconstrained optimization problems.
- Determine the solution for multivariable unconstrained optimization problems.
- Find the solution for the constrained non-linear optimization problems.
- Apply non-traditional optimization techniques to solve engineering problems.
- Apply the neural network-based optimization

## UNIT I SINGLE VARIABLE OPTIMIZATION ALGORITHM

Introduction - Engineering optimization problems - Optimality criteria - Bracketing methods - Region elimination methods - Point estimation methods - Gradient based methods - Root finding using optimization techniques - Computer Programmes.

## UNIT II MULTI VARIABLE OPTIMIZATION ALGORITHM

Optimality criteria - Unidirectional search - Direct search methods - gradient based methods - Computer programmes.

## UNITIII CONSTRAINED OPTIMIZATION ALGORITHMS

Kuhn-Tucker conditions - Transformation methods - sensitivity analysis - Direct search for constrained minization - Unearized search techniques method - Gradient projection method - Computer programmes

## UNIT IV SPECIALIZED ALGORITHMS

Integer programming - Geometric programming

## UNIT V NON TRADITIONAL OPTIMIZATION ALGORITHMS

Genetic algorithms - Simulated annealing - Global optimization - Computer programmes.

## **TEXT BOOK**

SL.N O	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Kalyanmoy	Optimization for Engineering	Prentice Hall of	2003
	Deb	Design, 5 <sup>th</sup> print	India, New	
			Delhi.	

## **REFERENCE BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Taha.H.A	Operations	Macmillan, New	1986
		Research	York.	
2.	Rao.S.S	Engineering	Wiley Eastern,	2009
		Optimization:	New Delhi.	
		Theory and		
		Practice, 4th Ed		
3.	Murthy.K.G	Linear	Wiley New York.	1987
		Programming	-	
4.	Reklaitis.G.V,Ravindran.A	Engineering	Wiley, New	2006
	and Regedit K.M	optimization	York.	
		methods and		
		applications		

#### **Course Objectives:**

- To provide knowledge on the fundamentals of aerodynamics and vehicle body optimisation.
- To introduce the use of wind tunnels in testing the vehicles.
- various aerodynamic shapes of car
- To introduce aerodynamics for design of the vehicle body
- To study the features of characteristics of forces and moments
- To understand the importance computational fluid dynamics analysis

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Explain the importance of aerodynamics for automobiles.
- Apply principles of aerodynamics for design of the vehicle body.
- Analyse the various aerodynamic shapes of car.
- Discuss the characteristics of forces and moments.
- Apply the concept of wind tunnel for the aerodynamic design of automobiles.
- Apply the computational fluid dynamics analysis.

## UNIT I INTRODUCTION

Scope - historical development trends - Fundamental of fluid mechanics - Flow phenomenon related to vehicles - External & Internal flow problem - Resistance to vehicle motion - Performance - Fuel consumption and performance - Potential of vehicle aerodynamics.

#### UNIT II AERODYNAMIC DRAG OF CARS

Cars as a bluff body - Flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - strategies for aerodynamic development - low drag profiles.

## UNITIII SHAPE OPTIMIZATION OF CARS

Front end modification - front and rear wind shield angle - Boat tailing - Hatch back, fast back and square back - Dust flow patterns at the rear - Effects of gap configuration - effect of fasteners.

## UNIT IV VEHICLE HANDLING

The origin of forces and moments on vehicle - side wind problems - methods to calculate forces and moments- vehicle dynamics under side winds - the effects of forces and moments - Characteristics of forces and moments - Dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.

## UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC

Introduction - Principle of wind tunnel technology - Limitation of simulation - Stress with scale models – full scale wind tunnels - measurement techniques - Equipment and transducers - road testing methods – Numerical methods.

## **TEXT BOOK**

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Hucho .W.H	Aerodynamic of Road vehicles	Butterworth's Co.	1997

## **REFERENCE BOOKS**

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1	Alan Pope William H. Rae Jewel B. Barlow	Low-Speed Wind Tunnel Testing, 3 <sup>rd</sup> Ed	John Wiley & Sons, New York.	1999
2	SAE	Automotive Aerodynamic	Update SP-706, SAE	1987
3	SAE	Vehicle Aerodynamic	SP-1145, SAE.	1996

## **15BEAE6E4 COMPUTATIONAL FLUID DYNAMICS**

#### Course Objectives:

- To introduce governing equations of viscous fluid flows.
- To acquaint the student with the concepts of finite difference and finite volume methods for diffusion.
- To familiarize the students to understand the finite volume method for convective diffusion
- To introduce numerical modelling and its role in the field of fluid flow and heat transfer.
- To provide knowledge on the various discretization methods, solution procedures and turbulence modelling.
- To impart knowledge on use of software tools.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Derive the governing equations and boundary conditions for fluid dynamics.
- Analyse finite difference and finite volume methods for diffusion.
- Analyse finite volume method for convective diffusion.
- Analyse the flow field problems.
- Explain and solve the turbulence models and mesh generation techniques.
- Use software tools.

## UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent flow - Turbulence -Kinetic -Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

## UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method.

Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

## UNITIII HEAT CONDUCTION

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

## UNIT IV CONVECTION AND DIFFUSION

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional convection and diffusion.

## UNIT V CALCULATION OF FLOW FIELD

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation  $(k-\epsilon)$  models.

## **TEXT BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Versteeg. H.K and	An Introduction	Longman	1998
	Malalasekera. W	to Computational		
		Fluid Dynamics:		
		The Finite		
		Volume Method		
2.	Ghosh dastidar. P. S	Computer	Tata McGraw-	1998
		Simulation of	Hill Publishing	
		flow and heat	Company Ltd.,	
		transfer	New Delhi.	

## REFERENCES

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Patankar. S.V	Numerical Heat	And- Books2004	1980
		Transfer and	Indian Edition,	
		Fluid Flow	McGraw-Hill,	
			New Delhi.	
2.	Muralidhar.K and	Computational	Narosa	1995
	Sundararajan.T	Fluid Flow and	Publishing	
		Heat Transfer	House, New	
			Delhi.	
3.	Bose.D.K,	Numerical Fluid	Narosa	1997
		Dynamics	publishing	
			House,New	
			Delhi.	
4.	Muralidhar.K and Biswas	Advanced	Narosa	1996
		Engineering	Publishing	
		Fluid Mechanics	House, New	
			Delhi.	

#### **15BEAE6E5 VIBRATION AND NOISE CONTROL**

3003100

#### Course Objectives:

- To impart knowledge on the basics of vibration and noise.
- To understand the importance of single degree and two degrees of freedom vibration systems.
- To equip them with skills to Calculate the total sound pressure level
- To enrich the understanding offrequency analysis
- To understandthe sources of vibration and noise.
- To learn the vibration and noise control techniques.

#### Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- List and explain the types of vibrations.
- Analyse a single degree and two degrees of freedom vibration systems.
- Calculate the total sound pressure levelproduced by two sounds of different levels.
- Apply frequency analysis
- Identify the sources of vibrationin automobiles.
- Design the systems to reduce vibration and noise.

## UNIT I SIMPLIFICATION OF VIBRATION PROBLEMS TO ONE DEGREE OF FREEEDOM

Basic equation of motion for various vibration problems – Torsional, Free, Damped and Forced vibration problems, critical speed, nature of exciting forces, vibration isolation, vibration instruments.

## UNIT II TWO AND MULTI-DEGREE OF FREEDOM SYSTEMS

Two degree – Formulation of solution - Coupling between rotating and translation - Applications. Multi degree – Governing equation for closed coupled systems - Lateral vibration, Geared systems - Effect of gyroscopic acceleration.

## UNITIII SOLUTION OF VIBRATION PROBLEMS

Approximate methods (or) Numerical methods – Holzer's method, Myklestadt's method, Sturn sequence Energy methods – Rayleigh's Approach – Closed coupled systems. For coupled systems – Dunkerley's method, Rayleigh Ritz method.

## UNIT IV DIAGNOSTICS AND FIELD MEASUREMENT

Diagnostic tools - Condition monitoring in real time - Balancing of rotors - Field measurements on various compressors, fans, machine foundation.

## UNIT V MACHINERY NOISE AND CONTROL

Basics of noise - Introduction, amplitude, frequency, wavelength and sound - Pressure level, noise dose level - Measurement and analysis of noise. Methods for control of noise - Mechanical noise - Predictive analysis, Sound in enclosures - Sound energy absorption - Sound transmission through barriers.

#### **TEXT BOOKS**

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF

		BOOK		PUBLICATION
1	Ramamurthy .V,	Mechanical	Narosa	2000
		Vibration	Publishing	
		Practice with	House, Chennai	
		Basic Theory		
2	Kewel Pujara	Vibration and	Dhanpatrai &	1992
	_	noise for	Sons	
		engineers		

## **REFERENCE BOOKS**

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Rao .J.S and Gupta. K	,.Introductory course on theory and practice of mechanical vibrations	Wiley Eastern, New Delhi.	1984
2	Rao.S.S	Mechanical vibrations,3 <sup>rd</sup> Edition	Wesley publishing company, New York	1995
3	Thomson.W.T	"Theory of Vibration and its Applications"	Prentice Hall, New Delhi	1982

## Course Objectives:

- To impart knowledge on significance of failure analysis in engineering design.
- To understand failure mechanism.
- To equip them with skills to handle the specific failure component
- To enrich the understanding of detailed root-cause analysis
- To understand the material factors that cause the failure
- To learn the corrective and preventive guidelines.

## Course Outcomes:

## Upon successful completion of the course, the students should be able to:

- Explain the significance of failure analysis in engineering design.
- Design and implement an appropriate strategy to handle the specific failure component
- Implement detailed root-cause analysis
- Apply various tools and techniques to identify the failure mechanism
- Describe the various material factors that cause the failure
- Propose appropriate corrective and preventive guidelines

## UNIT I MATERIALS AND DESIGN PROCESS

Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, designing for hostile environments, material processing and design, processes and their influence on design, process attributes, systematic process selection, screening, process selection diagrams, ranking, process cost.

## UNIT II FRACTURE MECHANICS

Ductile fracture, brittle fracture, Cleavage-fractography, ductile-brittle transition-Fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage

LINEAR ELASTIC FRACTURE MECHANICS: Griffith theory, Energy release rate, instability and R-curve, stress analysis of cracks-stress intensity factor, K-threshold, crack growth instability analysis, crack tip stress analysis.

## UNIT III ELASTIC PLASTIC FRACTURE MECHANICS

Crack tip opening displacement (CTOD), J integral, relationship between J and CTOD,DYNAMIC AND TIME-DEPENDENT FRACTURE: Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, Creep crack growth-C Integral, Visco elastic fracture mechanics, visco elastic J integral

## UNIT IV DETERMINATION OF FRACTURE TOUGHNESS VALUES

Experimental determination of plane strain fracture toughness, K- R curve testing, J measurement, CTOD testing, effect of temperature, strain rate on fracture toughness.

## UNIT V FAILURE ANALYSIS TOOLS

Reliability concept and hazard function, life prediction, life extension, application of poisson, exponential and Weibull distribution for reliability, bath tub curve, parallel and series system, MTBF,MTTR, FMEA definition-Design FMEA, Process FMEA, analysis causes of failure,

modes, ranks of failure modes, fault tree analysis, industrial case studies/projects on FMEA.

## **TEXT BOOKS**

SL.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHE	YEAR OF
NO			R	PUBLICATION
1.	John M. Barsom	Fracture and Fatigue Control in	Prentice	1987
	and Stanley T Rolte	Structures	Hall, New	
			Delhi.	
2.	ASM Metals	Failure Analysis and	ASM Metals	1995
	Handbook	Prevention, 10 <sup>th</sup> edition, Vol.10	Park, Ohio,	
			USA.	
3.	Michael F. Ashby	Material Selection in Mechanical	Butterworth	1999
		Design	Heinemann.	
		_		

## REFERENCES

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Shigley and Mischke	Mechanical Engineering	McGraw Hill.	1992
		Design		
2.	Mahmoud M.Farag	Material Selection for	Prentice Hall,	1997
		Engineering Design	New Delhi.	

Faculty of Mechanical Engineering, PSG College of Technology "Design Data Book", DPV Printers, 1993

#### Course Objectives:

- To impart knowledge on significance of CAD.
- To impart knowledge on Vehicle Frame and Suspension
- To acquire the ability in designing of Front Axle and SteeringSystems
- To acquire the ability in designing of Clutch
- To provide an overview ofdrawing of Gear Box
- To provide an overview of Drive Lineand Read Axle

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Acquire knowledge on significance of CAD
- Acquire knowledge on Vehicle Frame and Suspension
- Understand designing of Front Axle and Steering Systems
- Understand designing of Clutch
- Acquire knowledge on drawing of Gear Box
- Acquire knowledge on Drive Line and Read Axle

## UNIT I VEHICLE FRAME AND SUSPENSION

Study of loads - moments and stresses on frame members. Computer aided design of frame for passenger and commercial vehicle - Computer aided design of leaf springs - Coil springs and torsion bar springs.

## UNIT II FRONT AXLEAND STEERING SYSTEMS

Analysis of loads - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of bearings. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

## UNITIII CLUTCH

Torque capacity of clutch. Computer aided design of clutch components, Design details of roller and sprag type of clutches.

## UNIT IV GEAR BOX

Computer aided design of three speed and four speed gear boxes.

## UNIT V DRIVE LINEAND READ AXLE

Computer aided design of propeller shaft. Design details of final drive gearing. Design details of full floating. semi-floating and three quarter floating rear shafts and rear axle housings.

#### **TEXT BOOK**

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Dan Evans	Automobile Chassis Design	iliffe Books Ltd.	1992

## **REFERENCE BOOKS**

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1	Heldt.P.M,	Automotive	Chilton Co., New	1992
		Chassis	York	
2	Steeds.W	Mechanics of	iliffe Books Ltd,	1990
		Road vehicles	London.	
3	Newton, Steeds & Garrett	Motor vehicle	iliffe Books Ltd.,	2001
			London.	
4	Giri.N.K	Automobile	Khanna	2008
		Mechanics8th	Publisher, New	
		Edition	Delhi.	

## 15BEAE6E8PRINCIPLES OF MANAGEMENT AND ENTREPRENEURSHIP 3 0 0 3 100

## **Course Objectives**

- Evaluate the global context for taking managerial actions of planning, organizing and controlling.
- Assess global situation, including opportunities and threats that will impact management of an organization.
- Integrate management principles into management practices.
- Assess managerial practices and choices relative to ethical principles and standards
- To evaluation of organizational theories and human resource management principles
- To impart knowledge on Entrepreneurship

## **Course Outcome**

At the end of this course, students will be able to

- Synthesis of trends and issues as related to current professional practice
- Understand global situation, including opportunities and threats that will impact management of an organization
- Evaluation of organizational theories and human resource management principles
- Ability to Integrate management principles into management practices
- Analyze organizational theories and human resource management principles
- Understanding of Entrepreneurship

## UNIT I OVERVIEW OF MANAGEMENT

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally Strategies for International Business.

## UNIT II PLANNING

Nature and Purpose planning – Planning process – Types of plans – Objectives Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making Types of decision – Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

## UNIT III ORGANISING

Nature and purpose of organizing – Organization structure – Formal and informal groups organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Careerstages – Training –Performance Appraisal.

## UNIT IV DIRECTING AND CONTROLLING

Managing people- Communication- Hurdles to effective communication- Organization culture Elements and types of culture- Managing cultural diversity. Process of controlling- Types of control- Budgetary and non-budgetary control techniques Managing productivity- Cost control- Purchase control- Maintenance control-Quality control Planning operations

## UNIT V ENTREPRENEURSHIP

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.
# TEXTBOOK

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1.	Stephen P. Robbins and Mary Coulter	Management	Prentice Hall of In dia	8th Edition
2.	Charles W.L Hill, S teven L McShane	Principles of Management	Mcgraw Hill Education, Special Indian Edition.	, 2007

#### REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1.	Hellriegel, Slocum & Jackson	Management – A Competency Based App roach	Thomson South W estern	10 edition, 2007
2.	Harold Koontz, Hei nz Weihrich and ma rk V Cannice	Management – A global & Entrepreneurial Perspect ive	Tata Mcgraw Hill	12 edition, 200 7
3.	Andrew J. Dubrin	Essentials of Management	Thomson Southwe stern	7 edition,2007

# 15BEAE7E1AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS 3 0 0 3 100

# Course Objectives:

- To expose the different types of batteries and ignition systems.
- To provide knowledge on the working of starting system and charging system.
- To provide knowledge on automobile wiring system.
- To learn the automobile lighting system.
- To study the various sensors and actuators used in the automobile.
- To impart knowledge on the electronic engine management system.

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Sketch and explain the working principle of battery and ignition system.
- Discuss working of the starting system and charging system.
- Illustrate the automobile wiring system.
- Illustrate the automobile lighting system.
- Identify the sensors and actuators used in the automobile.
- Explain the electronic engine management system.

# UNIT I BATTERIES AND ACCESSORIES

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.

# UNIT II CHARGING SYSTEM

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

# UNITIII STARTING SYSTEM

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

# UNIT IV FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Current trends in automotive electronic engine management system, electro magnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.

# UNIT V SENSORS AND ACTIVATORS

Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2.	William B.Riddens	Understanding Automotive Electronics", 5 <sup>th</sup> Edition	Butterworth Heinemann Woburn	1988

## REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Bechhold	Understanding Automotive Electronics	SAE.	1998
2.	Crouse.W.H	Automobile Electrical Equipment, 3 <sup>rd</sup> Edition	McGraw-Hill Book Co., Inc., New York.	1986
3.	Judge.A.W	Modern Electrical Equipment of Automobiles	Chapman & Hall, London	1992
4.	Kholi.P.L	Automotive Electrical Equipment	Tata McGraw- Hill Co Ltd., New Delhi	1975
5.	Robert Bosch	Automotive Hand Book, 5 <sup>th</sup> Edition	SAE.	2000
6.	Ganesan.V	Internal Combustion Engines 4th Edition	TataMcGraw-HillPublishingCo., New Delhi	2012

# Course Objectives:

- To learn the various advanced driver assistance systems.
- To provide knowledge of the vehicle telematics.
- To impart knowledge on safety and security systems.
- To study the various comfort systems.
- To introduce the adaptive control systems.
- To introduce the concepts of the global positioning systems

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- List and explain the various driver assistant systems.
- Discuss the global positioning systems
- Describe the vehicle telematics and its applications.
- Explain the safety and security systems for automotive.
- Discuss the various comfort systems.
- Explain the adaptive control systems.

#### UNIT I DRIVER ASSISTANCE SYSTEMS

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, collision avoidance, vehicle status monitoring.

#### **UNIT IITELEMATICS**

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

#### UNITIII SAFETY AND SECURITY SYSTEMS

Airbags, seat belt tightening system, collision warning systems, child lock, anti lock braking systems. Anti theft technologies, smart card system, number plate coding.

#### UNIT IV COMFORT SYSTEMS

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column, power windows.

#### UNIT V ADAPTIVE CONTROL SYSTEMS

Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cutoff technology.

#### **TEXT BOOKS**

SL. NO	AUTHOR(S)	TITLE BOOK	OF THE	PUBLISHER	YEAR OF PUBLICATION
1.	Ljubo Vlacic, Michael	Intelligent	Vehicle	Butterworth-	2001

	Saren Harashir	and na	Fumio	Technologies		Heinemann publications,	
						Oxford	
2.	Ronald I	K.Jurge	n	Navigation	and	Automotive	1998
				Intelligent		Electronics	
				Transportation	Systems	Series,SAE,	
				-Progress	in	USA.	
				Technology			

# REFERENCES

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	William B Riddens	Understanding	Butterworth	1998
		Automotive Electronics,	Heinemann	
		5 <sup>th</sup> Edition	Woburn.	
2.	Bechhold,	Understanding	SAE	1998
		Automotive Electronics		
3.	Robert Bosch,	Automotive HandBook,	SAE	2000
		5 <sup>th</sup> Edition		

# MODERN VEHICLE TECHNOLOGY

# **15BEAE7E3**

# Course Objectives:

- To impart knowledge on trends in the vehicle power plants.
- To learn the various advanced driver assistance systems.
- To study the working of advanced suspension and braking systems in an automobile.
- To give information about motor vehicle emission and noise pollution control.
- To provide knowledge of the vehicle telematics.
- To give information about the noise control techniques

## Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Distinguish and describe the various modern vehicle power plant systems.
- List and explain the various driver assistant mechanisms.
- Identify and describe the working of advanced suspension and braking systems.
- Apply the knowledge of motor vehicle emission and noise pollution control.
- Describe the noise control techniques
- Describe the vehicle telematics and its applications.

# UNIT I TRENDS IN POWER PLANTS

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles - Electric propulsion with cables - Magnetic track vehicles.

# UNIT II SUSPENSION BRAKES AND SAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

# UNITIII NOISE & POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels/power plants - Catalytic converters and filters for particulate emission.

# UNIT IV VEHICLE OPERATION AND CONTROL

Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

# UNIT V VEHICLE AUTOMATED TRACKS

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1	Beranek.L.L	.Noise Reduction	McGraw-Hill	1993
			Book Co., Inc,	
			New York	
2	SAE	Bosch Hand book	3 <sup>rd</sup> Edition, SAE	1993

# **15BEAE7E4 AUTOMATION & MECHATRONICS**

# Course Objectives:

- To introduce the concept and working of sensors used in the mechatronic system.
- To study different types of actuators used in the mechatronic system.
- To provide knowledge on feedback mechanism for improving the reliability of the mechatronic system.
- To impart knowledge on working of microcontroller in the mechatronic system.
- To learn the Programmable Logic Controller (PLC) used in the mechatronic system.
- To expose students toprogram for PLC

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Select the different types of sensor for various mechatronics applications.
- Identify suitable actuator used in a mechatronic system.
- Design a feedback controller for mechatronic systems.
- Develop a controller using microcontroller for the mechatronic system.
- Describe the PLC
- Write a program for PLC used in the mechatronic systems.

# INTRODUCTION

Concept and scope of automation: Socio economic Consideration: Low cost automation. Necessity of Multidisciplinary study – Evolution of Mechatronics – Brief introduction to manufacturing – Principles of Mechatronics.

# UNIT I PNEUMATIC AND HYDRAULIC SYSTEMS

Hydraulics and pneumatic power supplies, Direction control valves, Pressure control valve: pressure limiting, pressure relief and pressure sequencing valves, speed control valve, servo valves and servo systems, time delay valves, shuttle valve, Actuators: Single acting and double acting cylinders, Cushion assembly, Rotary actuators, Vane Motor, Pilot operation, Cylinders sequencing and process control.

# UNIT II PROGRAMMABLE LOGIC CONTROLLER (PLC)

Function of PLC, Architecture, Components Of PLC, selection of PLC, Ladder Logic Diagram, and Logic Functions: latching, sequencing, counters, shift registers, jumpers, manipulation of data, arithmetic operations. Application of personal computer in control and automation: Data acquisition: ADC, ADC, DAC, digital input, digital output, control of DC motor, stepper motor. MEMS, Solid State Switches, Solenoid, DC/AC Motors, Stepper Motors.

# UNIT III ROBOTICS

Introduction, classification based on geometry, devices, control and path movements, End effectors- types and application: Sensors- types and application, Concept of Robotics/Machine vision, Teach Pendant. Application: Material transfer, machine loading /unloading, welding, assembly and spray painting operations.

# UNIT IV TRANSDUCERS, SENSORS&ACTUATORS

Define Transducer and Sensor - Transduction Principle – Transducer types – Photo emissive, Photoconductive and Photovoltaic Transducers – Thermistors – Thermo devices – Thermocouple – Inductive Transducers – Piezo-electric Transducer- Hall-effect Transducer – Strain-gauge type Transducers.

**Sensors:** Types – Active or Self-generating and Passive or Modulating types – Pressure Sensing – Variable resister, Variable Inductance, Variable differential transformer, Strain gauge and Piezo-resistive types – Position and Level sensing – Magnetic-variable reluctance, d.c.excited inductive, hall-effect, Reed Switch, Optical & Fibre Optics and Capacitance types – Air Flow Sensing – Hot wire, Flap type and Aneroid MAP – Temperature Sensing – Thermistor and Thermocouples – Gas Sensing – Exhaust Gas Oxygen Sensor – Knock Sensing.

Actuators: Introduction – Types and application areas – Stepper Motor – Pneumatic actuators – Valves - Hydraulic actuators.

# UNIT V MECHATRONIC SYSTEMS

Definition and approach of Mechatronics, Measurement and Control Systems and Mechatronics Approach. Traditional and Mechatronics design, possible Mechatronics design solutions, case studies.

# TEXT BOOKS

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Bolton.W	Mechatronics	Pearson	2003
			Education Asia,	
			New Delhi	
2.	Ramesh S. Gaonkar	Microprocessor	Penram	2013
		Architecture,	International,	
		Programming, and	India	
		Applications		
		with the 8085		
		6th Edition		

# REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Bradley D.A, Dawson.D,	Mechatronics	Chapman and Hall,	1993
	Buru.N.C and		New Delhi	
	Loader.A.J,			
2.	Dan Necsulesu	Mechatronics	Pearson Education	2002
			Asia, New Delhi.	
3.	Lawrence J. Kamm	Understanding Electro –	Prentice – Hall of	2000
		Mechanical Engineering,	India Pvt., Ltd.,	
		An Introduction to	New Delhi.	
		Mechatronics		
4.	Nitaigour Premchand	Mechatronics	Tata McGraw-Hill	2003
	Mahadik		publishing Company	
			Ltd, New Delhi.	
5.	Groover.M.P	Industrial Robotics –	McGraw-Hill, New	2001
		Technology, Programming	Delhi.	
		and Applications		

# 15BEAE7E5 LEAN MANUFACTURING 3003100

## Course Objectives:

- To acquire the general knowledge to deliver consistently high quality and value added products and services to the customer in a lean environment.
- To understand the terminology relating to lean operations in both service and manufacturing organizations.
- To impart knowledge on principles of lean manufacturing on the shop floor
- To enrich the understanding of just in time concept
- To expose students toconcepts of visual management, 5Sand total productive maintenance
- To expose students to Jidoka principle

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Summarise the quality requirements to provide products and services in a lean environment.
- Apply the principles of lean manufacturing on the shop floor.
- Explain the just in time
- Explain the concepts of visual management, 5Sand total productive maintenance.
- Examine the Jidoka principle.
- Illustrate the culture of lean management.

# UNIT I INTRODUCTION

Objectives of lean manufacturing-key principles and implications of lean manufacturing- Traditional Vs lean manufacturing – Lean benefits.

Lean Manufacturing Concepts: Value creation and waste elimination- Major kinds of waste- pull productiondifferent models of pull production-continuous flow-continuous improvement / Kaizen- Worker involvement.

# UNIT II GROUP TECHNOLOGY

Part family- Production flow analysis - Composite part concept - Machine cell design-Case studies.

# UNITIII LEAN MANUFACTURING TOOLS & METHODOLOGIES

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventive maintenance-total quality management-total productive maintenance-changeover/setup time -batch size reduction.

# UNIT IV VALUE STREAM MAPPING

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -poke yoka-Kanban – overall equipment effectiveness.

# UNIT V JITAND LEAN MANUFACTURING

Just In Time Manufacturing: Introduction - elements of JIT - Kanban system.

Implementing Lean - Road map-senior management Involvement-best practices.

Reconciling Lean With Other Systems: Toyota production system-lean six sigma-lean and ERP-lean with ISO9001: 2000

# **TEXT BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Michael L.George, David	What is Lean Six Sigma	McGraw-Hill,	2004
	T.Rowlands and Bill Kastle		New York.	
2.	Askin R.G and Goldberg J.B	Design and Analysis of	John Wiley	
		Lean Production	and Sons Inc.	
		Systems		
3.	Micheal Wader	Lean Tools: A Pocket	Productivity	2002
		guide to Implementing	and Quality	
		Lean Practices	Publishing Pvt	
			Ltd., New	
			Delhi.	

# REFERENCES

SL.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
NO				PUBLICATION
1.	Joseph D.E. Feo,	Juran Institute's Six Sigma	Tata McGraw-	2004
	William W Barnard	BreakThrough and Beyond	Hill Edition,	
			New Delhi	
2.	Richard B. Chase,	Operation Management	McGraw-Hill.	2003
	Robert Jacobs F and	for Competitive Advantage,		
	Nicholas J Aquilano	Tenth Edition.		
3.	Poka - Yoke	Improving Product Quality by	Productivity	1992
		Preventing Defects	Press.	
4.	Alan Robinson	Continuous Improvement in	Productivity	1991
		Operations	Press,	
		-	Portland,	
			Oregon.	

## 15BEAE7E6SUPPLY CHAIN MANAGEMENT 3 0 0 3 100

## Course Objectives:

- 1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturingtechnologies
- 2. To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
- 3. To explain basics of SCM and logistics
- 4. To impart knowledge need for inventorymanagement
- 5. To expose students to value of information inSCM
- 6. To understand the concept of information technology involved inSCM
- 7.

# Course Outcomes

On completion of this course, students will learn about

- 1. Basics of SCM.
- 2. Understand the need for inventorymanagement
- 3. Apply the need for value of information inSCM
- 4. Describe about the various strategicalliances
- 5. Explain about the various issues in the internationalSCM
- 6. Get knowledge in information technology involved inSCM

# UNIT IINTRODUCTION TO SUPPLY CHAIN MANAGEMENT

Definition, global optimization, objectives of SCM. Logistics networks- data collection, model and data elevation, solution techniques.

#### UNIT II INVENTORY MANAGEMENT

Introduction, single warehouse, Inventory examples, economic lot size model, effect of demand uncertainty. Risk pooling, centralized and decentralized system, managing inventory in the supply chain, forecasting.

# UNITIII VALUE OF INFORMATION

Bullwhip effect, information and supply chain technology. Supply chain integration- push, pull and pushpull system. Demand driven strategies, impact of internet on SCM, distribution strategies.

# UNIT IV STRATEGIC ALLIANCES

Framework for strategic alliance, third party logistics, retailer, supplies partnership, distributor- integration, procurement and out servicing strategies.

# UNIT VINTERNATIONAL ISSUES IN SCM

Introduction, risks and advantages- design for logistics, supplies integration into to new product development, mass customization. Issues in customer value.

Information Technology for SCM: Goals, standardization, infrastructure, DSS for supply chain management.

# **TEXT BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Simchi – Levi David,	Designing and	Tata McGraw-	2007
	Kaminsky Philip and Simchi-	Managing the	Hill Publishing	
	Levi Edith,	Supply Chain,	Company Ltd,	
		3 <sup>rd</sup> Edition	New Delhi.	
2.	Sunil Chopra and Peter	Supply Chain	Prentice Hall,	2006
	Meindl,	Management –	New Delhi	
		Strategy,		
		Planning and		
		Operation,		
		3 <sup>rd</sup> Edition		

# 15BEAE7E7 PROCESS PLANNING ANDCOST ESTIMATION 3 0 0 3 100

#### **Course Objectives:**

- To introduce the process planning concepts.
- To impart importance of the cost estimation process and procedures.
- To study the procedure to calculate direct, indirect and overhead expenses.
- To facilitate the understanding of the production cost of forging, welding, and foundry.
- To learn the procedure to estimate the various machining costs.
- To acquire the procedure to estimate the machining time for lathe, drilling, boring, shaping, milling and grinding operations.

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Explain the concepts of process planning and cost estimation.
- Assess the importance of cost estimation process and its procedures.
- Compute direct, indirect and overhead expenses.
- Determine the production cost of forging, welding, and foundry.
- Calculate the machining time for lathe, drilling, boring and shaping operations.
- Calculate the machining time for milling and grinding operations.

# UNIT I PROCESS PLANNING

Process Planning, selection and analysis – Manual, Experience based planning – CAPP, Variant, Generative - Processes analysis – Types of Production.

# UNIT II COSTING, ESTIMATION, COSTS AND EXPENSES

Aims of costing and Estimation – Functions and Procedure – Introduction to Costs, Computing Material cost, Direct Labor cost, Analysis of Overhead costs, Factory expenses, Administrative expenses, Selling and Distributing expenses – Cost Ladder - Cost of Product - Depreciation – Analysis of Depreciation.

# UNITIII ESITMATION OF COSTS IN DIFFERENT SHOPS

Estimation in Foundry shop – Pattern cost, Casting cost - Illustrative examples. Estimation in Forging Shop – Losses in forging – Forging cost - Illustrative examples

# UNIT IV ESTIMATION OF COSTS IN FABRICATION SHOPS

Estimation in welding shop – Gas cutting – Electric Welding - Illustrative examples. Estimation in sheet metal shop – Shearing and Forming - Illustrative examples

# UNIT V ESITMATION OF MACHINING TIMES AND COSTS

Estimation of machining time for lathe operations - Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations - Illustrative examples

# **TEXT BOOKS**

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1	Adithan.M.S and Pabla	Estimating and	Konark	1989
		Costing	Publishers vt.,	
			Ltd, New Delhi	
2	Chitale.A.K and Gupta.R.C	Product Design	Prentice Hall of	1997
		and	India, New Delhi	
		Manufacturing		

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1	Nanua Singh	.System Approach to	John Wiley Inc.	1996
		Computer Integrated		
		Design and		
		Manufacturing		
2	Joseph G. Monks	Operations Management	McGraw Hill	1982
		Theory and Problems	Book Company.	
3	Narang.G.B.S and	Production and Planning	Khanna	1995
	Kumar.V		Publishers ,New	
			Delhi.	
4	Banga.T.R and	Estimating and Costing	Khanna	1986
	Sharma.S.C		publishers,New	
			Delhi.	

# 15BEAE7E8 PROFESSIONAL ETHICS 3 0 0 3 100

#### Course Objectives:

- Provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
- To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis
- To have an idea about the Collegiality and Loyalty
- To provide knowledge on Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.
- To have an adequate knowledge about MNC's, Business, Environmental, Computer Ethics and Honesty.
- To understand Moral Leadership, sample Code of Conduct.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- The students will understand the basic perception of profession, professional ethics, various moral & social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
- The students will be aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.
- The students will acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.
- Knowledge on Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.
- Understand Moral Leadership, sample Code of Conduct

# **UNIT I ENGINEERING ETHICS**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professiona and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

# UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

# UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

# UNIT IV RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) -

# Discrimination

# UNIT V GLOBAL ISSUES

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

# **TEXT BOOKS**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1.	Mike Martin and Roland Schinzinger	Ethics in Engineering	McGraw Hill, New York	2005
2.	Charles E Harris, Michael S Pritchard and Michael J Rabins	Engineering Ethics – Concepts and Cases	Thompson Learning	2000

# **REFERENCES:**

			DUDI IGUED	
SL.NO.	AUTHOR(S)	IIILE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATI
				ON
1.	Charles D	Engineering Ethics	Prentice Hall, New	1999
	Fleddermann		Mexico	
2.	John R Boatright	Ethics and the Conduct of	Pearson Education	2003
		Business		
3.	Edmund G	Fundamentals of Ethics for	Oxford University	2001
	Seebauer and	Scientists and Engineers	Press	
	Robert L Barry			
4.	Prof. (Col) P S	Business Ethics – An	Biztantra, New	2004
	Bajaj and Dr. Raj	Indian Perspective	Delhi	
	Agrawal			
5.	David Ermann and	Computers, Ethics and	Oxford University	2003
	Michele S Shauf	Society	Press	

#### 15BEAE7E9 PRODUCTION PROCESS FOR AUTOMOTIVE COMPONENTS 3 0 0 3 100

# **Course Objectives:**

- To impart knowledge on basic principle and production methods of automotive components.
- To learn the surface coating technologies used in the automotive industry.
- To understand the importance of suitable process for the manufacturing automotive components.
- To enrich the understanding of casted and forged engine components
- To know the application of the emission control system
- To expose students to the stretch forming of auto body panels

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Select the materials for the components based on its functionality.
- Analyse suitable process for the manufacturing automotive components.
- List the casted and forged engine components.
- Select suitable surface coating technologies for the components.
- Describe the emission control system
- Explain the stretch forming of auto body panels.

# UNIT I FORMING PROCESS

Forging - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft ,propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles, Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydro forming: Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing. Stretch forming - Process, stretch forming of auto body panels -Super plastic alloys for auto body panels.

# UNIT II CASTING, MACHINING AND GEAR MANUFACTURING

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburettor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines. Hobbing and shaping - Gear finishing and inspection.

# UNITIII POWDER METALLURGY AND RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS

Process flow chart - Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes - Testing and inspection of PM parts.

Powder injection moulding – Shot peen hardening of gears - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons - aluminum composite brake rotors

# UNIT IV WELDING & ALLIED PROCESSES

Classification of Welding Processes; Arc Welding- Principle of Arc, Metal Transfer, Arc

Characteristics; Working and applications of Carbon Arc Welding, Flux Shielded Metal Arc Welding (SMAW), TIG (GTAW), MIG (GMAW), SAW and ESW; Resistance Welding- Spot, Seam, Projection and Flash Butt; Gas Welding- Oxy Acetylene and Oxy Hydrogen; Thermit Welding; Solid State Welding Processes; Fusion Welding Pool and Welding Defects, Allied Processes- Brazing and Soldering.

#### UNIT V UN CONVENTIONAL MACHINING PROCESSES

Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. Electric Discharge Machining (EDM) - Wire cut EDM - Chemical machining and Electro-Chemical machining (CHM and ECM) Laser Beam machining (LBM), plasma Arc machining (PAM) and Electron Beam Machining - Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications

IEAI BOOKS					
SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION	
1.	Heldt.P.M	High Speed Combustion Engines	Oxford Publishing Co., New York	1990	
2.	Philip F.Ostwald and Jairo Munoz	Manufacturing Processes and Systems	John Wiley & Sons, New York	Reprint 2008	

#### **TEXT BOOKS**

#### REFERENCES

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Haslehurst.S.E	Manufacturing Technology	ELBS, London	1990
2.	Rusinoff	Forging and forming of metals	D.B.Taraporevala Sons & Co. Pvt Ltd., Mumbai	1995
3.	Sabroff.A.M	Forging Materials & Processes	Reinhold Book Corporation, New York.	1988
4.	ASTME	High Velocity Forming of Metals	Prentice Hall of India (P) Ltd., New Delhi	1990

#### 15BEAE8E1

#### **Course Objectives:**

- To gain knowledge of fundamentals of the automotive air conditioning.
- To study the working of automotive cooling and heating systems.
- To provide knowledge on air conditioning controls, delivery system and refrigerants.
- To impart knowledge on working of automatic temperature control.
- To learn the system servicing and testing.
- To impart knowledge on special tools for servicing

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Apply the psychrometry principles.
- Explain the components of vehicle air conditioning systems.
- Describe the air conditioning controls.
- Select the suitable sensors and actuators for automatic temperature control.
- Discover and troubleshoot the fault in vehicle air conditioning systems.
- Describe the special tools for servicing vehicle air conditioning

# UNIT I AIRCONDITIONING FUNDAMENTALS

Basic air conditioning system - Location of air conditioning components in a car - Schematic layout of a refrigeration system. Compressor components - Condenser and high pressure service ports. Thermostatic expansion value - Expansion value calibration - Controlling evaporator temperature - Evaporator pressure regulator - Evaporator temperature regulator.

# UNIT II AIR CONDITIONER - HEATING SYSTEM

Automotive heaters - Manually controlled air conditioner - Heater system - Ford automatically controlled air conditioner and heater systems - Automatic temperature control - Air conditioning protection – Engine protection.

# UNITIII REFRIGERANTS

Containers - Handling refrigerants - Tapping into the refrigerant container - Refrigeration system diagnosis - Diagnostic procedure - Ambient conditions affecting system pressures.

# UNIT IV AIR ROUTING & TEMPERATURE CONTROL

Objectives - Evaporator care air flow through the Dash recirculating unit - Automatic temperature control – Duct system - Controlling flow - Vacuum reserve - Testing the air control and handling systems.

# UNIT V AIR CONDITIONING SERVICE

Air conditioner maintenance and service - Servicing heater system Removing and replacing components. Trouble shooting of air controlling system - Compressor service.

# **TEXT BOOK**

SL.NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	William H. Crouse and Donald L Anglin	Automotive Air conditioning	McGraw-Hill Inc.	1990

SL.NO	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
		BOOK		PUBLICATION
1	Mitchell	Mitchell	Prentice Hall	1989
		Automatic	India	
		Heating and Air		
		Conditioning		
		Systems		
2	Paul Weller	Automotive Air	Reston	1990
		Conditioning	Publishing Co	
			Inc.	
3	MacDonald.K.L,	Automotive Air	Theodore Audel	1978
		Conditioning	series	
4	Goings.L.F	Automotive Air	American	1978
		Conditioning	Technical	
			services	

## 15BEAE8E2ALTERNATE FUELS AND ENERGY SYSTEMS3 0 0 3 100

#### Course Objectives:

- To acquire knowledge of alternative fuels and changes in the engine design for handling them.
- To learn the various energy systems for use in the automobiles.
- To equip them with skills to modify the engines
- To make the students conversant of biofuels
- To make the students conversant of synthetic fuels
- To give exposure tocombustion, performance and emission characteristics of engines

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Analyse the thermodynamics of combustion characteristics of alternative fuels.
- Distinguish the various types of alternative fuels based on need and scope.
- Modify the engines according to the type of alternative fuel.
- Explain the biofuels
- Explain the synthetic fuels
- Analyse the combustion, performance and emission characteristics of engines

# UNIT I INTRODUCTION

Estimation of petroleum reserve - Need for alternate fuel - Availability and properties of alternate fuels – general use of alcohols - LPG - Hydrogen - Ammonia, CNG, and LNG - Vegetable oils and Biogas - Merits and demerits of various alternate fuels.

# UNIT II ALCOHOLS

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine. Methanol and gasoline blends - Combustion characteristics in engines - emission characteristics.

# UNITIII NATURAL GAS, LPG, HYDROGEN AND BIOGAS

Availability of CNG, properties, modification required to use in engines - performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG - Hydrogen – Storage and handling, performance and safety aspects.

# UNIT IV VEGETABLE OILS

Various vegetable oils for engines - Esterification - Performance in engines - Performance and emission Characteristics

# UNIT V ELECTRIC AND SOLAR POWERED VEHICLES

Layout of an electric vehicle - Advantage and limitations - Specifications - System component. Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar powered vehicles.

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Maheswar Dayal	Energy today &	I & B Harish	1982
		tomorrow	India.	
2.	Nagpal.G.K	Power Plant	Khanna	2002
		Engineering	Publishers, New	
			Delhi.	
3.	Bechtold.R.L	Alternative Fuels	SAE	1997
		Guide Book		

# Course Objectives:

- To impart knowledge on advancement in IC engine construction and combustion process.
- To familiarise the combustion modelling.
- To enrich the understanding of advances in IC Engines
- To expose students to performance of the IC engines
- To facilitate the understanding of computer control of engine parameters
- To impart knowledge onperformance maps

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Explain the operating cycles of SI engines, CI engines and gas turbines.
- Understand the IC engine combustion processes.
- Analyse the causes of knocking in combustion.
- Apply new techniques to improve the performance of the IC engines.
- Explain the computer control of engine parameters for pollution control
- Explain the performance maps.

# UNIT I CYCLE ANALYSIS

Operating cycles of S.I. and C.I. engines and Gas turbines - Comparison of Air standard cycle - Fuel air cycle and actual cycle.

# UNIT II COMBUSTION OF FUELS

Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels - Chemical energy and heating values - Chemical equilibrium and maximum temperature - SI engine combustion - Flame velocity and area of flame front - CI engine combustion. Fuel spary characteristics - droplet size, penetration and atomization.

# UNITIII COMBUSTION MODELLING

Basic concepts of engine simulation - Governing equation - Flow models, thermodynamic models - SI engine and CI engine models.

# UNIT IV ADVANCES IN IC ENGINES

Adiabatic and L.H.R. engines - MAN combustion chamber and multifuel engines - Stratified charged and lean burn engines - Locomotive and marine engines.

# UNIT V OPERATION AND PERFORMANCE

Computer control of engine parameters for pollution control and better efficiency - Closed loop control of engine parameters - Hybrid operation - performance maps.

# **TEXT BOOK**

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBI	LISHER	YEAR OF PUBLICATION
1.	Ganesan.V	Internal combustion engines, 4 <sup>th</sup> Edition	Tata Hill	McGraw Publishing	2012

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Ganesan.V	Computer	Universities Press	1996
		Simulation of	(India) Ltd,	
		Spark Ignition	Hyderabad.	
		engine process		
2.	John.B.Heywood	Internal	McGraw Hill	2011
		Combustion	Publishing Co.,	
		Engine	New York.	
		Fundamentals		

# 15BEAE8E4FUELCELL TECHNOLOGY

# **Course Objectives:**

- To address the need and promise of alternative clean energy.
- To introduce the concept of fuel cells for use in automobiles.
- To learn the fuel cell components and their impact on performance.
- To impart knowledge on Alkaline Fuel Cells & Phosphoric Acid FuelCells
- To impart knowledge onSolid Oxide Fuel Cells & Molten Carbonate FuelCells
- To impart knowledge onDirect Methanol and Proton Exchange Membrane Fuel Cells

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- List the types of fuel cells.
- Explain the thermodynamics and electrochemical kinetics of fuel cells.
- Describe the fuel cell performance characteristics
- Explain the various components of the fuel cell.
- Describe the various types of fuel cells
- Understand the working of various types of fuel cells

# UNIT I INTRODUCTION AND THERMODYNAMICS

Introduction: Basic operating principles – Historical highlights – Classification. Thermodynamics: Electrochemical energy conversion – Theoretical efficiency – Electrochemical energy conversion – Factors affecting electrochemical energy conversion

# UNIT II ELECTRODE KINETICS

Electrode double layer – Electrolyte double layer – Double layer models (Helmoltz model, Gouy-Chapman Model, Stern model, Grahame model – Bockris, Devenathan and Muller model, and chemical models) – Solid metallic electrode – Semiconductor electrode – Specific adsorption – Zero potential.

# UNITIII ALKALINE FUEL CELLS & PHOSPHORIC ACID FUEL CELLS

Alkaline Fuel Cells: Working principle – Components – Modules and stacks – Performance characteristics (power density, space applications, atmospheric pressure cells) – Limitations and R&D challenges – System issues – Ammonia as fuel. Phosphoric Acid Fuel Cells: Cell reactions – Electrodes (stability of catalysts, electrode fabrication – fuel cell performance) – Stacks and systems.

# UNIT IV SOLID OXIDE FUEL CELLS & MOLTEN CARBONATE FUEL CELLS

Solid Oxide Fuel Cell: Principle of operation - Benefits and limitations – Cell components (electrolytes, zirconia systems, ceria based electrolytes, perovskite-based systems) – Cathode materials – Anode materials – Interconnects – Fuel reactions –Configurations and performance (tubular, monolithic, planar) – Environmental impact – Applications. Molten Carbonate Fuel Cell: General principle – Components (electrolyte and matrix, cathode and anode materials) – Electrode reactions – Life time

## UNIT V DIRECT METHANOL AND PROTON EXCHANGE MEMBRANE FUEL CELLS

Direct Methanol Fuel Cells, Operating principle: – Noble metal issue – Electro-oxidation of methanol (catalysts, oxygen electro-reduction, electrolyte, non-catalytic aspects) - Methanol crossover – Catalyst optimization – Vapor feed versus liquid feed cells.

Proton Exchange Membrane Fuel Cells:Operating principle (membranes, electrodes and electrolysis, optimization of membrane and electrode assembly,

Impurities) – Technology development (single cell and stacks, composite plates) – Fuel processing – Modeling studies (membrane, electrode, membrane-electrode assembly, fuel cell, stack and system) – Technology development and applications.

#### **TEXT BOOKS**

SL.	AUTHOR(S)	TITLE OF	THE	PUBLISHER	YEAR OF
NO		BOOK			PUBLICATION
1.	Viswanathan.B and Scibioh M.	Fuel	Cells	Universities Press	2006
	Aulice	Principles	and	(India) Pvt. Ltd.,	
		Applications	5	Hyderabad.	
2.	Hoogers.G	Fuel	Cell	CRC Press,	2003
		Technology		Washington D. C	
		Handbook		-	

SL.	AUTHOR(S)	TITLE OF	THE	PUBI	ISHER	YEAR OF
NO		BOOK				PUBLICATION
1.	Larminie. J and Dicks. A,	Fuel	Cell	John	Wiley &	2003
		Systems		Sons,	Ltd., New	
		Explained,		York.		
		2 <sup>nd</sup> Edition				

# 15BEAE8E5 QUALITY CONTROL AND RELIABILITY ENGINEERING 3003100

#### **Course Objectives:**

- To introduce the concept of Statistical Quality Control (SQC).
- To familiarise with various statistical process control methods.
- To study the methods and characteristics of sampling.
- To describe the concept of reliability and its models.
- To impart knowledge on the design of reliability process.
- To describe the concept of product life cycles

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Summarise the concept of quality and process control for variables.
- Apply the process control for attributes.
- Explain the importance of sampling methods and their characteristics.
- Explain the concept of life testing.
- Evaluate the reliability concept with their models.
- Explain the product life cycles

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and  $\sigma$  chart.

#### UNIT II PROCESS CONTROL FOR ATTRIBUTES

Control chart for attributes -control chart for proportion or fraction defectives - p chart and np chart - control chart for defects - C and U charts, State of control and process out of control identification in charts.

#### UNITIII ACCEPTANCE SAMPLING

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

# UNIT IV LIFE TESTING - RELIABILITY

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

# UNIT V QUALITY AND RELIABLITY

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Note: Use of approved statistical table permitted in the examination.

# **TEXT BOOKS**

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Grant, Eugene .L	Statistical Quality	McGraw-Hill,	1996
		Control	New Delhi.	
2.	Srinath. L.S	Reliability	Affiliated East	1991
		Engineering	west press.	

#### REFERENCES

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	Monohar Mahajan	Statistical Quality	Dhanpat Rai &	2001
		Control	Sons, New Delhi.	
2.	Besterfield.D.H,	Quality Control	Prentice Hall, New	1993
			Delhi.	
3.	Sharma.S.C	Inspection Quality	Khanna Publishers,	1998
		Control and Reliability	New Delhi.	
4.	Connor. P.D.T.O	Practical Reliability	John Wiley,	2002
		Engineering,	London.	
		4 <sup>th</sup> Edition		

# 15BEAE8E6INTELLECTUAL PROPERTY RIGHTS (IPR)3003100

## Course Objectives:

- To introduce the basic concepts of Intellectual Property Rights (IPR).
- To compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
- To study the various agreements and legislation related to IPR.
- To learn digital products and law.
- To provide knowledge on enforcement of IPRs.
- To provide knowledge on the Infringement of IPRs

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Outline the basic concepts of intellectual property rights.
- Explain the registration of copyrights, trademarks, patents, geographical indications, trade secrets and industrial design registration.
- State the various agreements and legislation related to IPR.
- Describe digital products and law.
- Explain the enforcement measures of IPRs.
- Explain the Infringement of IPRs

#### UNIT I

Introduction - Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property i. Movable Property ii. Immovable Property and iii. Intellectual Property).

#### UNIT II

IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration - Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures.

# UNIT III

International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities - History - General Agreement on Trade and Tariff (GATT).

# UNIT IV

Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

#### UNIT V

Case Studies on Patents - Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

# **TEXT BOOK**

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Subbaram.N.R	Handbook of Indian Patent	S. Viswanathan	1998
		Law and Practice	(Printers and	
			Publishers) Pvt.	
			Ltd.	

SL. NO	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Eli Whitney	United States Patent Number	72X, Cotton Gin	March 14, 1794.

# 15BEAE8E7 VEHICLE TRANSPORT MANAGEMENT

#### 3 0 0 3 100

#### Course Objectives:

- To study Transport Management
- To understand the concept of Organisation
- To learn about Vehicle Maintenance
- To be aware of the Supply Management andBudget
- To provide knowledge onScheduling and FareStructure
- To introduceMotor Vehicle Act

# Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Acquire in-depth knowledge of Transport Management.
- Analyse concept of Organisation.
- Describe Vehicle Maintenance.
- Knowledge on Supply Management and Budget.
- Knowledge on Scheduling and FareStructure.
- Awareness on Motor Vehicle Act

# UNIT I ORGANISATION AND MANAGEMENT

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

# UNIT II VEHICLE MAINTENACE

Scheduled and unscheduled maintenance - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options.

# UNITIII VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems - Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses - Fleet management and data processing - Data processing systems - Software. Model - Computer controlling of

fleet activity - Energy management.

# UNIT IV SCHEDULING AND FARE STRUCTURE

Route planning - Scheduling of transport vehicles - Preparation of timetable – preparation of vehicle and crew schedule - Costs, fare structure – Fare concessions - Methods of fare collection - Preparation of fare table.

# UNIT V MOTOR VEHICLE ACT

Schedules and sections - Registration of motor vehicles - Licensing of drivers and conductors - Control of permits - Limits of speed - traffic signs - Constructional regulations - Description of goods carrier, delivery van, tanker, tipper, municipal, fire fighting and break down service vehicle.

SL.	AUTHOR(S)	TITLE OF THE	PUBLISHER	YEAR OF
NO		BOOK		PUBLICATION
1.	John Dolu	Fleet Management	McGraw-Hill Co.	1984
2.	Rex W. Faulks	Bus and Coach	Butterworth.	1987
		Operation		
3.	Kitchin L.T.D	Bus operation, 3 <sup>rd</sup>	iliffe and Sons	1992
		Edition	Ltd., London.	

#### Course Objectives:

- To understand the vehicle aerodynamics.
- To impart knowledge on body construction of the car, bus and commercial vehicles.
- To study the body materials, mechanisms and repair.
- To impart knowledge on the safety aspect of bus body
- To introduce the concepts of regulations
- To expose students to material used in bodybuilding, tools used and body repairs

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Distinguish the various aerodynamic forces and moments.
- Explain different aspects of the car body, bus body and commercial vehicle.
- Describe the safety aspect of bus body
- Describe the commercial vehicle bodies
- Explain the regulations.
- Describe the material used in bodybuilding, tools used and body repairs.

#### UNIT I CAR BODY

Types: Saloon, Convertibles, Limousine, Estate Van, racing and sports car - Driver's seat, Body Mechanisms - window winding, Door lock, seat adjustment. Driver's visibility and tests for visibility. Minimum space requirements and methods of improving space in cars. Safety - safety design, safety equipments. Car body construction.

#### UNIT II BUS BODY

Types: Mini bus, single and double decker, two level, split level and articulated bus. Bus body layout – Floor height - Engine location - Entrance and exit location - Seating dimensions.

Constructional details: Frame construction, Double skin construction -Types of metal section used - Regulations -Conventional and integral type construction.

#### UNITIII COMMERCIAL VEHICLE

Types: Flat platform, drop side, fixed side, tipper body, tanker body. LCV body types: pickup, van. Dimensions of driver's seat in relation to controls and steering angle -Driver cab design.

#### UNIT IV VEHICLE AERODYNAMICS AND ERGONOMICS

Objectives -Vehicle drag and types - various types of forces and moments -Effects of forces and moments – Side wind effects -Various body optimization techniques for minimum drag –Wind tunnel testing: Flow visualization techniques, Scale model testing, Component balance to measure forces and moments. Simple problems.

**ERGONOMICS:** Introduction, seating dimensions, interior ergonomics, ergonomics system design, seat comfort, suspension seats, split frame seating, back passion reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout.

# UNIT V BODY MATERIALS, TRIM AND MECHANISMS

Aluminium alloy sheet, extrusion and casting, stainless steels, alloy steels, Metal Matrix Composites. Structural timbers -properties. Designing in GRP and high strength composites, Thermo plastics, Load bearing plastics, semi-rigid PUR foams and sandwich panel construction. Corrosion, Anticorrosion methods. Selection of paint and painting process -Body trim items.

# **TEXT BOOK**

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Powloski.J	Vehicle Body Engineering	Business Boob Ltd.	1989

SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF
				PUBLICATION
1.	Giles.J.C	Body construction and	Iliffe Boob	1971
		design	Butterworth &	
			Со	
2.	John Fenton	Vehicle Body layout and	Mechanical	1982
		analysis	Engg Publication	
			Ltd, London	
3.	Braithwaite.J.B	Vehicle Body building and	Heinemann	1977
		drafting	Educational	
		_	Book-I Ltd.,	
			London.	
4.	Dieter Anselm	The Passenger Car Body	ISBN Number:	2000
			0-7680-0708-9,	
			SAE	
			International	

# 15BEAE8E9 INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH 3 0 0 3 100

# Course Objectives:

- To familiarise the production planning methodologies and layout design.
- To learn the concept of work study.
- To impart knowledge on the basics of linear programming techniques.
- To understand the transportation and assignment models.
- To provide knowledge on the importance of inventory control.
- To provide knowledge on economicorderquantity

# Course Outcomes:

# Upon successful completion of the course, the students should be able to:

- Select suitable production planning methodologies, production system and plant layout for the industry.
- Execute an effective work study and ergonomics for better productivity.
- Formulate and select a suitable method to solve the linear programming problem.
- Solve different transportation and assignment-based models.
- Solve the inventory decision-making problem usingmathematical modelling.
- Describe the economicorderquantity

# UNIT I INTRODUCTION

Evolution of industrial engineering, fields and functions of industrial engineering. Methods engineering process charts, motion study, work sampling and work measurement.

# UNIT II PRODUCTION PLANNING AND CONTROL

Introduction, objectives, components of PPC, manufacturing systems, plant layout, types of layouts, forecasting, product planning, loading and scheduling, dispatching, production control, material handling principles, case studies.

Human engineering- Ergonomics, design of controls and displays, heating, ventilation, glare, airflow, influence of factory environment on productivity, industrial safety.

Cost analysis - Cost structure of a product-labor, material, overhead. Overhead absorption, machine hour rate, cost computation for simple machined components, learning curve, 'Make-or-Buy' decision.

# UNITIII LINEAR PROGRAMMING TECHNIQUES

Operations research and decision-making, types of mathematical models and constructing the model. Role of computers in operations research, formulation of linear programming problem, applications and limitations, simplex method, variants in simplex method (analytical and graphical).

# UNIT IV DISTRIBUTION METHODS AND ASSIGNMENT MODELS

Vogel's approximation method, modified distribution method, optimization models, unbalance and degeneracy in transportation model. Hungarian algorithm, traveling salesman problem, routing problems, processing 'n' jobs through two machines and three machines, processing two jobs through 'm' machines.

# UNIT V INVENTORY CONTROL

Variables in inventory problems, inventory models with penalty, storage and quantity discount, safety stock, inventory models with probability, lead time, demand, multi item deterministic model.

TEXT BOOKS					
SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON	
1.	Frederick S.Hillier and Gerald J.Lieberman	Introduction to Operations Research	Tata McGraw Hill Publishing Company Ltd., New Delhi	2006	
2.	Chase R.B, Jacob F.R.E.D and Aquilano N.J	Operations Management for Competitive Advantage, 10 <sup>th</sup> Edition	Tata McGraw Hill, New Delhi	2004	
3.	Elwood S. Buffa	Modern Production /Operations Management 8 <sup>th</sup> Edition	Wiley Eastern, New Delhi.	2007	
4.	Kanti Swarup Gupta P.K and Manmohan	Operations Research	Sultan Chand and Sons, New Delhi.	1995	

#### DEFEDENCES

KEFEKI	ENCES			
SL.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATI ON
1.	Srinath.C	PERT and CPM – Principles and Applications 3 <sup>rd</sup> Edition	East West Press, New Delhi	2001
2.	Dharani Venkatakrishnan.S	Operations Research	Keerthi Publication House, Coimbatore	1991
3.	D. Kannappan, D Paranthaman, A. G Augustine	Mechanical Estimating and Costing	Tata mcGraw Hill, (New Delhi :)	2003
4.	Saravanan.R	Manufacturing optimization through intelligent techniques	CRC Press, Florida.	2006
5.	Gupta.P.K and Hira.D.S	Operations Research	S. Chand & Co, New Delhi.	2012
6.	Panneerselvam.R	Production and Operations Management, 2 <sup>nd</sup> Edition	Prentice Hall of India (P) Ltd.	2007
#### 15BEAE65\_

### INDUSTRIAL ROBOTICS 11 0 1100

#### Course Objectives:

- To learn the construction and fundamentals of robots.
- To provide knowledge on types of drives and end effectors in robots.
- To impart knowledge on sensors and machine vision system.
- To provide knowledge on the applications of robots in industries.

#### Course Outcomes:

#### Upon successful completion of the course, the students should be able to:

- Identify the components and construction of robot manipulator.
- Understand the sensors
- Select a suitable drive and an end effectfor industrial robots.
- Choose sensors and machine vision system for industrial robots.
- Discuss the usage and applications of robots in industries.
- Understand the economic analysis of robots

### PART – I FUNDAMENTALS OF ROBOT

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications. Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features. End Effectors – Grippers. Requirements of a sensor, Principles and Applications of sensors – Position of sensors, Proximity Sensors, Touch Sensors - Camera, Frame Grabber, Sensing and Digitizing Image.

#### PART – II ROBOT CELL DESIGN

Robot cell design – simulation software (Robo Wave). Robot cell layouts – Multiple robots and machine interference – robot cell planning – robot cycle time analysis for assembly, welding and painting shop. Safety Considerations for Robot Operations, Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

#### 15BEAE65\_ COMPUTER HARDWARE AND INTERFACING 11 0 1 100

PART I CPU-CPU essentials – processor modes – modern CPU concepts – Architectural performance features – the Intel's CPU – CPU over clocking – over clocking requirements – over clocking the system – over clocking the Intel processors – Essential memory concepts – memory organizations – memory packages – modules – logical memory organizations – memory considerations – memory types – memory techniques – selecting and installing memory. Active motherboards – sockets and slots – Intel D850GB – Pentium4 mother board – expansion slots – form factor – upgrading a mother board – chipsets – north bridge – south bridge – CMOS – CMOS optimization tactics – configuring the standard CMOS setup – motherboard BIOS – POST – BIOS features – BIOS and Boot sequences – BIOS shortcomings and compatibility issues – power supplies and power management – concepts of switching regulation – potential power problems – power management.

#### PART-II Interface

Parallel port – signals and timing diagram – IEEE1284 modes – asynchronous communication - serial port signals – video adapters – graphic accelerators – 3D graphics accelerator issues – DirectX – mice – modems – keyboards – sound boards – audio bench marks.

### 15BEAE75\_ FUELS AND LUBRICANTS

#### PART I MANUFACTURE OF FUELS AND LUBRICANTS

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

11 0 1 100

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

#### PART II PROPERTIES AND TESTING OF FUELS

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapour pressure, flash point, Fire point, Self Ignition Temperature, Higher calorific value, Lower calorific value, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, etc.

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

### 15BEAE75\_ AUTOMOTIVE ERGONOMICS AND SAFETY11 0 1 100

### PART I VEHICLE ERGONOMICS:

Introduction, seating dimensions, interior ergonomics, ergonomics system design, seat comfort, suspension seats, split frame seating, back passion reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout.

**ENVIRONMENTAL CONDITIONS:**Illumination, heat ventilation and air conditioning, noise, motion, speed and acceleration, sound, vibration.

**PART II HUMAN FACTORS APPLICATIONS:**Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO/DIS6385, OSHA's approach, virtual environments.

**SAFETY**: Seat belt, air bag, collapsible steering, warning systems, ABS braking system, collision safety systems, global safety standards in automotive applications

### **OPEN ELECTIVES** (Offered by other Departments)

### **SCIENCE AND HUMANITIES**

#### **15BESHOE01**

#### **INDUSTRIALMATHEMATICSI**

#### **COURSE OBJECTIVES:**

- 1. To develop analytical skills for solving engineering problems
- 2. To teach the students the basic concepts of LPP,
- 3. To learn the techniques to solve transportation problems
- 4. To learn the techniques to solve Assignment problems
- 5. To make the students to study about the Integer Programming and Network Analysis
- 6. Analyse the results and propose recommendations to the decision-making processes in Management Engineering

#### **COURSE OUTCOMES:**

- 1. To define and formulate linear programming problems and appreciate their limitations.
- 2. To solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
- 3. To be able to build and solve Transportation Models, Assignment Models,
- 4. To construct linear integer programming models and discuss the solution techniques.
- 5. To formulate and solve problems as networks and graphs.
- 6. To be able to solve problems in different environments and develop critical thinking

### UNITI LINEARPROGRAMMINGPROBLEM

Formulation of LPP - Graphical Method - Simplex Method - Artificial variable technique and two phase simplex method. Duality - Dual and simplex method - Dual Simplex Method.

### UNITII TRANSPORTATIONPROBLEM

Transportation Model, finding initial basic feasible solutions, moving towards optimality, Degeneracy.

### UNITIII ASSIGNMENTPROBLEM

Solution of an Assignment problem, Multiple Solution, Hungarian Algorithm, Maximization in Assignment Model, Impossible Assignment.

### UNITIV INTEGERPROGRAMMING

Integer Programming Problem - Gromory's fractional cut Method - Branch Bound Method

### UNITV NETWORKANALYSIS

PERT & CPM- network diagram-probability of achieving completion date- crash time- cost analysis. **TEXT BOOKS** 

### TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi.	2013
2	Kanti Swarup, Manmohan, Gupta	Operations Research	Sultan Chand & Sons	2010

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Natarajan A.M., Balasubramani P.,	Operations Research	Pearson Education,	2005
2	Srinivasan G	Operations Research	Eastern Economy Edition	2007

9

9

9

9

3	Winston	Operations Research, Applications and Algorithms	Cengage Learning	2004
---	---------	--	------------------	------

- 1. www.mathcentre.ac.uk
- 2. www.mathworld. Wolfram.com
- 3. www.mit.edu

#### **15BESHOE02**

#### **COURSE OBJECTIVES**

- 1. To kindle analytical skills for solving engineering problems
- 2. To impact the knowledge about inventory models
- 3. To learn replacement models
- 4. To learn about simulation models
- 5. To provide techniques for effective methods to solve nonlinear programming and decision making.
- 6. To analyse the results and propose recommendations to the decision-making processes in Management Engineering

#### **COURSE OUTCOMES**

The students will

- 1. To be able to solve simple models in Inventory problems and Replacement problems.
- 2. To understand different queuing situations and find the optimal solutions using models for different situations.
- 3. Simulate different real life probabilistic situations using Monte Carlo simulation technique.
- 4. To be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.
- 5. **Convert** and **solve** the practical situations into replacement models.
- 6. To understand how to model and solve problems using non integer programming.

### UNITI INVENTORYMODELS

Economic order quantity models-techniques in inventory management-ABC analysis.

### UNITII NONLINEARPROGRAMMING

Khun-tucker conditions with non-negtive constraints- Quadratic programming- Wolf's modified simplex method.

### UNITIII SIMULATIONMODELS

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\M\1): ( $\infty$ \FIFO), (M\M\c): ( $\infty$ \FIFO) Models.

### UNITIV DECISIONMODELS

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk-

Decision – Tree Analysis.

### UNITV REPLACEMENTMODELS

Models based on models that gradually detoriate with time-whose maintenance cost increase with time-Replacement of items that fail suddenly and completely.

### TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi .	2013
2	Kanti Swarup, Manmohan, Gupta	Operations Research	Sultan Chand & Sons	2010

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Natarajan A.M., Balasubramani P.,	Operations Research	Pearson Education,	2005
2	Srinivasan G	Operations Research	Eastern Economy Edition	2007

9

9

#### 9

9

15BESHOE02

3

#### WEB REFERENCES

Winston

- 1. www.mathcentre.ac.uk
- 2. www.mathworld. Wolfram.com
- 3. www.mit.edu

# 15BESHOE03PROBABILITY AND RANDOM PROCESSCOURSE OBJECTIVES

9

9

9

9

9

# 1. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communicationengineering.

- 2. To understand the basic concepts of probability, one- and two-dimensional random variables
- 3. To introduce some standard distributions applicable to engineering which can describe real lifephenomenon.
- 4. To understand the basic concepts of random processes which are widely used in ITfields.
- 5. To understand the concept of correlation and spectral densities.
- 6. To understand the significance of linear systems with randominputs.

#### **COURSE OUTCOMES**

Upon successful completion of the course, students should be able:

- 1. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real lifephenomenon.
- 2. To understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
- 3. To apply the concept random processes in engineeringdisciplines.
- 4. To understand and apply the concept of correlation and spectral densities.
- 5. The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
- 6. To analyze the response of random inputs to linear time invariantsystems.

#### UNITI MEASURES OF CENTRAL TENDENCYANDPROBABILITY

Measures of central tendency – Mean, Median, Mode - Standard Deviation Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem.

#### UNITII STANDARDDISTRIBUTIONS

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – Chebyshev'sinequality.

#### UNITIII TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions - Covariance - Correlation and regression

#### UNITIV CLASSIFICATION OFRANDOM PROCESS

Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

#### UNITV CORRELATION ANDSPECTRALDENSITIES

Autocorrelation-Crosscorrelation-Properties-Powerspectral density-Crossspectral density-Properties

Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function Linear time
invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation
functions of input andoutput.

#### TEXT BOOK

TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Peebles Jr, P.Z	Probability Random Variables and Random Signal Principles	Tata McGraw-Hill Pubishers, New Delhi.	2002

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Henry Stark and John W. Woods	Probability and Random Processes with Applications to Signal Processing	Pearson Education, Third edition, Delhi	2002
2	Ross, S	A first Course in Probability	Pearson Education, New Delhi (Chap 2 to 8)	2012
3	Gupta, S.C. and Kapur, V.K	Fundamentals of Mathematical Statistics	Sultan Chand and Sons, New Delhi.	2014

	15BE	SHOE03	PROBABILITY AND RANDOM PROCESS	3003100
-	4	Veerarajan,T.	Probabilitiy, Statistics and Random Tata McGraw-Hill Publications, process Second Edition, New Delhi	, 2012

- WEB REFERENCES
  1. www.cut-theknot.org/probability.shtml
  2. www.mathcentre.ac.uk

  - 3. www.mathworld. Wolfram.com

# 15BESHOE04PROBABILITY AND STATISTICAL METHODSCOURSE OBJECTIVES

- 1. This course aims at providing the required skill to apply the statistical tools in engineering problems.
- 2. To introduce the basic concepts of probability and random variables.
- 3. To introduce about the concepts of random distributions
- 4. To introduce the basic concepts of two dimensional random variables.
- 5. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- 6. To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

#### **COURSE OUTCOMES**

- 1. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- 2. To understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- 3. To apply the concept of testing of hypothesis for small and large samples in real life problems.
- 4. To apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- 5. To have the notion of sampling distributions and statistical techniques used in engineering and management problems.

**6.** To make the student acquire sound knowledge of techniques in quality control that model engineering problems.

### UNITI MEASURES OF CENTRAL TENDENCYANDPROBABILITY

Measures of central tendency – Mean, Median, Mode and Standard Deviation – SPSS Software Demonstration.

Probability - Random variable - Axioms of probability - Conditional probability - Total probability - Baye's

theorem - Probability mass function - Probability density functions.

### UNITII STANDARDDISTRIBUTIONS

Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma, and Normal distributions

- Moment generating functions, Characteristic function and their properties.

### UNITIII TWO DIMENSIONALRANDOMVARIABLES

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

### UNITIV TESTINGOFHYPOTHESIS

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness offit.

### UNITV DESIGNOF EXPERIMENTS

Analysis of variance - One way classification - CRD - Two way classification - RBD - Latin square.

### TOTAL 45PERIODS

Note: Use of approved statistical tables permitted in the examination.

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gupta. S.C. and Kapur. V.K	Fundamentals of Mathematical Statistics	Sultan Chand and Sons, New Delhi.	2014
2	Athanasios Papoulis and S Pillai	Probability Random variables and Stochastic Processes	McGraw-Hill Publications, New Delhi.	2002

### 9

9

9

9

#### **15BESHOE04 PROBABILITY AND STATISTICAL METHODS**

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Walpole. R.E., Myers. R.H., and Ye. K	Probability and Statistics for Engineers and Scientists	Pearsons Education, Delhi.	2007
2	Lipschutz. S. and Schiller. J	Schaum's outlines - Introduction to Probability and Statistics	McGraw-Hill, New Delhi.	1998
3	Ross. S	A first Course in Probability	Pearson Education, Delhi	2014
4	Johnson. R.A	Miller & Freund's Probability and Statistics for Engineers	Pearson Education, Delhi	2014

- 1. www.cut-theknot.org/probability.shtml
- www.mathcentre.ac.uk
   www.mathworld. Wolfn www.mathworld. Wolfram.com

# 15BESHOE05PROBABILITY AND QUEUING THEORYCOURSE OBJECTIVES

### 3003100

9

9

9

9

9

- 1. To understand the fundamental knowledge of probability theory.
- 2. To introduce the concept of random variable and functions of random variables.
- 3. To introduce the basic concepts of two dimensional random variables.
- 4. To introduce the concepts of random processes and Markov chain
- 5. To understand the different Queuing models
- 6. To understand how to solve problems using various models

#### **COURSE OUTCOMES**

- 1. The student gain the knowledge in measures of central tendency and probability
- 2. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- 3. Understand the basic concepts of two dimensional random variables and apply in engineering applications.
- 4. Understand the concepts of random process and markov chains
- 5. They will be able to solve the Queuing models
- 6. The students understand and characterize phenomena which evolve with respect to time in a probabilistic manner.

#### UNITI PROBABILITY AND RANDOM VARIABLE

Axioms of probability - Conditional probability - Total probability – Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functions and their properties.

#### UNITII STANDARDDISTRIBUTIONS

Functions of a random variable - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties.

#### UNITIII TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

#### UNITIV RANDOM PROCESS ANDMARKOVCHAINS

Classification - Stationary process - Markov process - Poisson process - Birth and death process - Markov chains - Transition probabilities - Limiting distributions.

#### UNITV QUEUEINGTHEORY

Markovian models - M/M/1, M/M/C, finite and infinite capacity - M/M/ $\infty$  queues - Finite source model - M/G/1 queue (steady state solutions only) - Pollaczek - Khintchine formula - Specialcases.

#### TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ross.S	A first course in probability	Pearson Education, Delhi	2014
2	Medhi.J	Stochastic Process	New Age Publishers ,New Delhi	2014

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Veerarajan.T	Statistics and Random Processes	Tata McGraw-Hill, 2nd Edition, New Delhi.	2008
2	Allen.O	Probability, Statistics and Queuing Theory	Academic press, New Delhi.	1999
3	Gross.D. and Harris. C.M	Fundamentals of Queuing theory	John Wiley and Sons, New York.	2008

(5050)00

15BESHOE05		SHOE05	PROBABILITY AND QUEUING THEORY		3 0 0 3100
	4	Taha.H.A	Operations Research - An Introduction	Pearson Education Edition Asia, Delhi.	2006

- www.mathcentre.ac.uk
   www.mathworld. Wolfram.com
   www.mit.edu

9

9

9

9

9

#### **COURSE OBJECTIVES**

#### Students should

- 1. Be able to understand basic knowledge of fuzzy sets and fuzzy logic
- 2. Be able to apply basic knowledge of fuzzy operations.
- 3. Able to know the basic definitions of fuzzy relations
- 4. Be able to know about the fuzzy measures
- 5. Be able to apply basic fuzzy inference and approximate reasoning
- **6.** To know the applications of fuzzy Technology.

#### **COURSE OUTCOMES**

- 1. To gain the main subject of fuzzy sets.
- 2. To understand the concept of fuzziness involved in various systems and fuzzy set theory.
- 3. To gain the methods of fuzzy logic.
- 4. To comprehend the concepts of fuzzy relations.
- 5. To analyze the application of fuzzy logic control to real time systems.
- 6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

#### UNITI FUZZYSETS

Fuzzy Sets: Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – F u z z y functions - Zadeh's Extension Principle

#### UNITII OPERATIONS ONFUZZYSETS

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

#### UNITIII FUZZYRELATIONS

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

#### UNITIV FUZZYMEASURES

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

#### UNITV FUZZYINFERENCE

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference - Compositional rule of Inference - Efficiency of Inference - Hierarchical

TOTAL 45PERIODS

#### TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	George J Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic : Theory and Applications	Prentice Hall NJ	2003

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	H.J. Zimmermann	Fuzzy Set Theory and its Applications	Allied Publishers, New Delhi	2001
2	Kevin M Passino and Stephen Yurkovich	Fuzzy Control	Addison Wesley Longman	1998

3	Michal Baczynski and Balasubramaniam	Fuzzy Implications	Springer Verlag, Heidelberg	2008
---	---	--------------------	-----------------------------	------

- 1. www.mathcentre.ac.uk
- 2. www.mathworld. Wolfram.com
- 3. www.doc.ic.ac.uk
- 4. www.calvin.edu/~pribeiro/othrlnks/Fuzzy/fuzzysets.htm

#### **15BESHOE07**

#### **COURSE OBJECTIVES**

- 1. To know the fundamentals of Tensors
- 2. To know the series solutions to differential equations
- *3.* To introduce the concepts of special functions
- 4. To study about Calculus of variations
- 5. To study about the integral equations
- 6. To know how to solve problems for above functions and equations

### **COURSE OUTCOMES**

- 1. Students will demonstrate proficiency in mathematics and the mathematical concepts needed for a proper understanding of physics.
- 2. Learn about special type of matrices that are relevant in physics and then learn about tensors.
- 3. Get introduced to Special functions like Bessel, Legendre, Hermite and Laguerre functions and their recurrence relations
- 4. Learn different ways of solving second order differential equations and familiarized with singular points and Frobenius method.
- 5. Students will master in calculus of variations and linear integral equations.
- 6. The students will have the knowledge on Mathematical Physics and that knowledge will be used by them in different engineering and technology applications.

#### UNITI TENSORS

Definition of tensor - rank, symmetric tensors, contraction, quotient rule - tensors with zero components, tensor equations, metric tensors and their determinants - pseudotensors

#### UNITII DIFFERENTIALEQUATIONS-SERIES SOLUTIONS

Series Solution : Classification of singularities of an ordinary differential equation - Series solution-Method of Frobenius - indicial equation -examples

#### UNITIII SPECIALFUNCTIONS

Basic properties (Recurrence and Orthogonality relations, series expansion) of Bessel, Legendre , Hermite and Laguerre functions – Generating Function

#### UNITIV CALCULUS OFVARIATIONS

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functional dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric Problems – Direct methods – Ritz and Kantorovich methods.

#### UNITV LINEARINTEGRALEQUATIONS

Introduction – conversion of a linear differential equation to an integral equations and vice versa – conversion of boundary value problem to integral equations using Green's function – solution of a integral equation – integral equations of the convolution type – Abel's integral equations –integra–differential equations – integral equations with separable kernels – solution of Fredholm equations with separable kernels.

TOTAL 45PERIODS

S. No	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dr. Grewal B.S.	Higher Engineering Mathematics	40 <sup>th</sup> edition, , Khanna Publishers	2013
2	Stephenson, G, Radmore. P.M	Advanced Mathematical Methods for Engineering and Science students	Cambridge University Press	1990
3	Andrews, Larry C.	Special Function for Engineers and Applied Mathematicians	Macmillan, New York	1997

#### REFERENCES

#### 9

12

8

8

15BESHOE07		SHOE07	MATHEMATICAL PHYSICS		3 0 0 3100
	4	Murray R Spiegel, Dennis Spellman	Vector Analysis	Tata Mc Graw Hill Education Pvt. Ltd., New Delhi	2010

- 1. http://www.doitpoms.ac.uk/
- www.phys.uu.nl/~thooft/lectures/specialfct.pdf
   http://www.math.umn.edu/~olver/pdn.html
- 4. http://tutorial.math.lamar.edu/classes/DE.aspx

#### 15BESHOE08 ADVANCED ENGINEERING MATHEMATICS

#### **COURSE OBJECTIVES**

- 1. To introduce the concepts of special functions.
- 2. To find the solutions to partial differential equations and their applications
- **3.** To study about mathematical physics and perturbation techniques
- 4. To learn replacement models and simulation models
- 5. To provide techniques for effective methods to solve nonlinear programming
- **6.** To provide techniques for decision making

#### **COURSE OUTCOMES**

- 1. Students know the concepts of improper integrals, Beta and Gamma functions.
- 2. The students acquire sound knowledge of techniques in solving PDE that model engineering problems.
- **3.** Identify the situations where singular perturbations are needed. They will be able to use various modifications of matched asymptotic expansions techniques to derive asymptotic solutions.
- 4. To be able to understand the characteristics of different types of decision-making environments and the appropriate decision-making approaches and tools to be used in each type.
- 5. **Convert** and **solve** the practical situations into replacement models.
- **6.** To understand how to model and solve problems using non-integer programming.

#### UNITI INTRODUCTION TO SOMESPECIAL FUNCTIONS

Gamma function, Beta function, Bessel function, Error function and complementary Error function, Heaviside's function, pulse unit height and duration function, Sinusoidal Pulse function, Rectangle function, Gate function, Dirac's Delta function, Signum function, Saw tooth wave function, Triangular wave function, Half wave rectified sinusoidal function, Full rectified sine wave, Square wave function.

#### UNITII PARTIAL DIFFERENTIAL EQUATIONSANDAPPLICATIONS

Formation PDEs, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Nonlinear PDEs first order, Some standard forms of nonlinear PDE, Linear PDEs with constant coefficients, Equations reducible to Homogeneous linear form, Classification of second order linear PDEs. Separation of variables use of Fourier series, D'Alembert's solution of the wave equation, Heat equation: Solution by Fourier series and Fourier integral

#### UNITIII PERTURBATIONTECHNIQUES

Singular perturbations (algebraic example). Notion of the boundary layer. Inner and outer solutions. Overlap region. Matching of the asymptotic expansions. Ordinary differential equations with singular perturbations. Methods to determine location of the boundary layer.

#### UNITIV SIMULATIONMODELS

Elements of simulation model -Monte Carlo technique – applications. Queuing model: problems involving (M\M\1):  $(\infty \setminus FIFO)$ , (M\M\c):  $(\infty \setminus FIFO)$  Models.

#### UNITV DECISIONMODELS

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk-Decision – Tree Analysis.

TOTAL	45PERIODS
TOTAL	45PERIODS

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kreyszig. E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Gupta. A.S.	Calculus of Variations with Applications	Prentice Hall of India Pvt. Ltd., New Delhi	2008
3	Sankara Rao. K.	Introduction to Partial Differential Equations	Prentice Hall of India Pvt. Ltd., New Delhi	2010
4	Ali H Nayfeh	Perturbation Methods	John Wiley & Sons, New Delhi.	2008

9

9

9

9

15BESHOE08		SHOE08 AI	<b>JOVANCED ENGINEERING MATHEMATICS</b>		3003100
	5	Hamdy Taha. A.	Operations Research	Prentice – Hall of India Private Limited, New Delhi.	2010

- www.phys.uu.nl/~thooft/lectures/specialfct.pdf
   www.maths.manchester.ac.uk/~bl/teaching/math34011/
   pubsonline.informs.org/journal/opre

#### **COURSE OBJECTIVES**

- **1.** To introduce the basic concepts of vector space
- 2. To know the fundamentals of linear Algebra
- 3. To solve system of linear equations
- 4. To study about the linear transformations
- 5. To study about the eigen values and eigen vectors
- 6. To introduce the concepts of inner product spaces

#### COURSE OUTCOMES

The student will be able to

- 1. To explain the fundamental concepts of advanced algebra
- 2. To explain their role in modern mathematics and applied contexts.
- 3. To apply the fundamental concepts in their respective engineering fields
- 4. To visualize linear transformations as matrix form
- 5. To recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
- 6. To articulate the importance of Linear Algebra and its applications in branches of Mathematics

#### UNITI VECTORSPACES

General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space

#### UNITII EIGEN VALUES ANDEIGENVECTORS

Eigen values and Eigen vectors - diagonalization - Power method - QR decomposition

#### UNITIII SYSTEM OF LINEAREQUATIONS

Direct methods, Gauss elimination method, Gauss Jordan method, Crout's method, iterative methods, Gauss-Jacobi method, Gauss-Seidel method, convergence criteria.

#### UNITIV LINEARTRANSFORMATIONS

Linear Transformations - The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

#### UNITV INNERPRODUCTSPACES

The Dot Product on R<sup>n</sup> and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

#### TOTAL 45PERIODS

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kreyszig,E	Advanced Engineering Mathematics	John Wiley & Sons, New Delhi.	2014
2	Anton and Rorres	Elementary Linear Algebra, Applications version	Wiley India Edition	2012
3	Jim Defranza, Daniel Gagliardi	Introduction to Linear Algebra with Application	Tata McGraw-Hill	2008

#### WEB REFERENCES

- 1. www.sosmath.com
- 2. www.linear.ups.edu
- 3. www.mathworld.wolfram.com
- 4. www.tutorial.math.lamar.edu

9

Q

### 9

#### **COURSE OBJECTIVES**

- 1. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- 2. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- 3. To acquaint the student with Fourier, transform techniques used in wide variety of situations.
- **4.** To introduce the basic concepts of PDE for solving standard partial differential equations
- 5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
- **6.** To develop Z transform techniques for discrete time systems.

#### **COURSE OUTCOMES**

- 1. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- 2. The learners can equip themselves in the transform techniques and solve partial differential equations
- 3. Understand how to solve the given standard partial differential equations.
- 4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- 5. Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- 6. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

#### UNITI FOURIERSERIES

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

#### UNITII FOURIERTRANSFORM

Fourierintegraltheorem(withoutproof)–Fouriertransformpair–SineandCosinetransforms–Properties– Transforms of simple functions – Convolution theorem – Parseval's identity.

#### UNITIII PARTIALDIFFERENTIALEQUATIONS

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

#### UNITIV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

#### UNITV Z-TRANSFORM ANDDIFFERENCEEQUATIONS

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform. TEXT

BOOKS

#### TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Grewal, B.S.	Higher Engineering Mathematics	Khanna Publishers, Delhi.	2013
2	Erwin Kreyszig	Advanced Engineering Mathematics.	Wiley India (P) Ltd, New Delhi.	2014

9

9

### 9

9

#### **15BESHOE10 TRANSFORMS AND PARTIAL DIFFERENTIAL**

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venkateswarlu S	Engineering Mathematics, Vol I	Anuratha Agencies and Publishers, Kumbakonam.	2007
2	Narayanan, S., and Ramaniah, G	Advanced Mathematics for Engineering Students. Volumes II and III,	Viswanathan S Printers and Publishers Pvt. Ltd. Chennai.	2002
3	Bali N P.	A text book of Engineering Mathematics	Laxmi Publications Pvt. Ltd.	2006
4	Ramana B V	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Co. Ltd. New Delhi.	2008

- 1. www.sosmath.com
- 2. http://mathworld.wolfram.com/FourierSeries.html
- http://www.math.umn.edu/~olver/pdn.html
   http://tutorial.math.lamar.edu/classes/DE/IntroPDE.aspx

#### 15BESHOE11

### **COURSE OBJECTIVES**

- 1. Develop abilities to write technically and expressively,
- 2. Recognize writing as a constructive, meaningful process,
- 3. Practice using reading strategies for effective writing.
- 4. Design effective technical documents for both print and digital media
- 5. Identify the qualities of good technical writing
- 6. To lean avoiding similarity index.

### **COURSE OUTCOMES**

- Construct simple sentences, correct common grammatical errors in written English.
- Develop confidence in English language by imbibing lexical and syntax rules.
- Enrich their reading ability for effective writing.
- Elevate them to minimize word, sentence, and paragraph length without sacrificing clarity or substance
- Familiarize with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
- Demonstrate the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

### UNITI BASICSOFWRITING

Introduction to Technical Writing – Importance of Writing – Characteristics of Writing– Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow– Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing– Overcoming writer's block – Prioritizing for effective writing– Avoiding plagiarism.

### UNITII PARAGRAPHS ANDESSAYS

Expressing Ideas – Paragraph construction – Cohesion and Coherence – Adequate development – Kinds of paragraphs – Writing drafts – Paragraph length and pattern – Types of Essays – Characteristics of Essays – Salient point of sentence constructions.

### UNITIII LETTERS, MEMOS ANDEMAIL

Formal written correspondence – Types of messages – Business letters – Structure of letters – Language in letters – Tense in letters – Cover letters – Resumes – Curriculum vitae – Memos – Emails – Email Etiquette – Effectiveness and purpose.

### UNITIV THE ART OF CONDENSATION AND TECHNICAL PROPOSALS 9

StepstoEffectivepréciswriting–Guidelines–TechnicalProposals–TypesofProposals–Characteristics– Body of the Proposals – Style and appearance – Evaluation of proposals – Proof Reading – Book /FilmReview

- Travelogue - DialogueWriting.

### UNITV REPORTS ANDRESEARCHARTICLES

Discussion of newspaper articles -Objectives of Reports – Characteristics of Reports – Structure of Reports – Types of Reports – Writing an article – Writing research articles – Essential features of Dissertation – Organizing the structure of thesis and articles – Writing technical description.

### TOTAL 45PERIODS

#### 9

9

9



S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	V.N. Arora and Lakshmi Chandra	Improve Your Writing: Revised First Edition	OUP	2014

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Crème, P. and M. Lea.	Writing at University: A guide for students.	OUP	2003
2	Graham King	Collins Improve Your Writing	Collins; First edition	2009
3	David Morley	The Cambridge Intro. To Creative Writing	Cambridge	2010

#### **15BESHOE12**

#### **COURSE OBJECTIVES**

- 1. To inculcate the basics of brief history of Earth sciences
- 2. To divulge knowledge on the basics of structure of earth and earth's gravitational field.
- 3. To disseminate the fundamentals of magnetic field and thermal distribution of earth.
- 4. To introduce the concepts of seismology and seismic waves
- 5. To impart the basic knowledge of oceans

6. To Apply the knowledge gained from this course to solve the relevant problems in engineering stream.

#### **COURSE OUTCOMES**

- 1. Gain knowledge on the basics of history of Earth sciences.
- 2. Acquire knowledge on concepts of structure of earth and earth's gravitational field.
- 3. Have adequate knowledge on the concepts of magnetic field and thermal distribution of earth
- 4. Obtain knowledge on the basics of seismic waves.
- 5. Understand the basics of oceans and properties of sea water.
- 6. Apply the knowledge gained from this course to solve the relevant problems in engineering stream.

### UNITI ORIGINOFEARTH

A brief history of the development of Earth Sciences and of Geophysics in particular, An overview of Geophysical methods and their essential features, Problems of inversion and non-uniqueness in Geophysics, Origin & evolution of Solar system, Earth and Moon structure,. Kepler's law of planetary motion, A review of the Earth's structure and composition

### UNITII STRUCTUREOFEARTH

Chemical composition of Earth, Rheological behavior of crust and upper mantle, viscoelasticity and rock failure criteria, Geochronology: Radiometric dating and their advantages, meaning of radiometric ages, Major features of the Earth's gravitational field and relationship with tectonic processes in the crust and upper mantle, concept of isostasy, mathematical concept of Airy and Pratt hypotheses of isostasy

### UNITIII MAGNETIC FIELD AND THERMAL DISTRUBUTIONOFEARTH 9

Origin of geomagnetic field, polar wandering, secular variations and westward drift, reversals of geomagnetic field, sun spot, solar flares, geomagnetic storms, sea-floor spreading, Paleomagnetism and its uses, Thermal history of the Earth, sources of heat generation and temperature distribution inside the earth, convection in the mantle

### UNITIV SEISMOLOGY

Earthquake seismology, Earthquakes and its classifications, Global seismicity and tectonics, Earth's internal structure derived from seismology, Earthquake mechanism and Anderson's theory of faulting, Continental drift and plate tectonics: its historical perspective and essential features, present day plate motions, Triple junctions, oceanic ridges, Benioff zones, trenches and island arcs, hot spots, Mantle Plume, Mountain building, origin of Himalaya, Geodynamics of Indian subcontinent.

### UNITV OCEANS

Physical properties of seawater and methods of determination, distribution of salinity in the oceans, factors affecting salinity, water masses and water type, TS Diagram, Circulation of currents in major ocean waves. Tides: Dynamical and equilibrium theory of tides. Marine pollution, steps to control marine pollution, Laws of seas, Coastal zone management

### TOTAL 45PERIODS

TEXT BOOK

95

# 9

### 9

9

	15RFSHOF12		CEOPHVSICS		3 0 0 3100
-	S.	Author(s) Name	Title of the book	Publisher	Year of
	No.	Author (s) Mante	The of the book	Tublisher	Publication
	1	B.F. Howell	Introduction to Geophysics	McGraw-Hill	2007

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	W. Lowrie	Fundamentals of Geophysics	Cambridge University Press,	2007
2	J.A.Jacobs, R.D.Russel	Physics and Geology	McGraw-Hill	2002

- 1. www.ocw.mit.edu
- www.physicsclassroom.com
   www.nptel.ac.in
   www.physics.org

#### 15BESHOE13

#### **COURSE OBJECTIVES**

- 1. To disseminate the fundamentals of acoustic waves.
- 2. To inculcate the characteristics of radiation and reception of acoustic waves.
- 3. To teach the concepts of radiation and reception of acoustic waves
- 4. To divulge knowledge on the basics of pipe resonators and filters.
- 5. To introduce the features of architectural acoustics.
- 6. To impart the basic knowledge of transducers and receivers.

#### **COURSE OUTCOMES**

- 1. Develop the idea of the fundamentals of acoustic waves.
- 2. Apply the concepts of radiation and reception of acoustic waves.
- 3. Explain the basic ideas of pipe resonators and filters.
- 4. Illusrate the basics of architectural acoustics.
- 5. Illustrate the transducers and receivers and its applications in various electronic devices.
- 6. Apply the knowledge inputs of the course for engineering applications.

### UNITI INTRODUCTION

Acoustics waves – Linear wave equation – sound in fluids – Harmonic plane waves -Energy density – Acoustics intensity – Specific acoustic impedance – spherical waves – Describer scales. Reflection and Transmission: Transmission from one fluid to another normal and oblique incidence –method of images.

### UNITII RADIATION AND RECEPTION OFACOUSTICWAVES

Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation impedance - Fundamental properties of transducers. Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

### UNITIII PIPES RESONATORS ANDFILTERS

Resonance in pipes - standing wave pattern absorption of sound in pipes - long wavelength limit - Helmoltz resonator - acoustic impedance - reflection and transmission of waves in pipe - acoustic filters - low pass, high pass and band pass. Noise, Signal detection, Hearing and speech. Noise, spectrum level and band level - combing band levels and tones - detecting signals in noise - detection threshold - the ear - fundamental properties of hearing - loudness level and loudness - pitch and frequency - voice.

### UNITIV ARCHITECTURALACOUSTICS

Sound in endosure – A simple model for the growth of sound in a room – reverberation time - Sabine, sound absorption materials – measurement of the acoustic output of sound sources in live rooms – acoustics factor in architectural design. Environmental Acoustics: Weighted sound levels speech interference – highway noise – noise induced hearing loss – noise and architectural design specification and measurement of some isolation design of portions.

### UNITV TRANSDUCTION

Transducer as an electives network – canonical equation for the two simple transducers transmitters – moving coil loud speaker – loudspeaker cabinets – horn loud speaker, receivers – condenser – microphone – moving coil electrodynamics microphone piezoelectric microphone – calibration of receivers

9

9

9

### 9



#### ТЕХТВООК

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	LawerenceE.Kinsler, Austin R.Frey,	Fundamentals of Acoustics	4ht edition, John Wiley & Sons	2000

#### REFERENCE

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	F. AltonEverest& Ken Pohlmann	Master Handbook of Acoustics	McGraw Hill Professional	2014

#### WEB REFERENCES

- 1. www.acousticalsociety.org
- 2. www.acoustics-engineering.com

3. www.nptel.ac.in

4. www.ocw.mit.edu

### COURSE OBJECTIVES

- 1. <u>To understand about the fuel</u>
- 2. To study about the alcohols
- 3. To study importance of alcohols in engine
- 4. To gain knowledge on the fuel gas and oils
- 5. To get the information on fuel cell
- 6. To understand electric, hybrid and solar cars

### **COURSE OUTCOMES**

- 1. Students will know about the basic concepts of alternate fuels
- 2. Students will know about the basic concepts of alcohols.
- 3. Students will understand about fuel gas and oils
- 4. Students can enrich their knowledge about the alternate fuels and energy systems
- 5. Develop their knowledge in studies of vegetable oils
- 6. Students knows about the importance of electric, hybrid and solar cars

### UNITI INTRODUCTION

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources and significance.

### UNITII ALCOHOLS

Properties as engine fuel, alcohols and gasoline blends, performance in SI engines, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

### UNITIII NATURAL GAS, LPG, HYDROGENANDBIOGAS

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG & LPG in SI & CI engines, performance and emission of LPG. Hydrogen storage and handling, performance and safety aspects. Production of Biogas and its applications

## UNITIV VEGETABLEOILS

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, biodiesel and its characteristics.

## UNITV ELECTRIC, HYBRID, FUEL CELL ANDSOLARCARS

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

## TOTAL 45PERIODS

**9** 3,

9

# 9

9

#### **15BESHOE14** ALTERNATE FUELS AND ENERGY SYSTEMS 3003100 S. Year of Author(s) Name Title of the book Publisher No. Publication 1 Richard.L.Bechfold Alternative Fuels Guide Book SAE International Warren dale 2002 Jain, P.C. and Dhanpat Rai Publishing Company 2 Engineering Chemistry. 2009 Monika Jain (P) Ltd., New Delhi.

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nagpal G R	Power Plant Engineering	Khanna Publishers	2002
2	Saeid Mokhatab William A Poe	Hand book of Natural Gas Transmission and Processing	Gulf Professional Publisher, USA	2012

#### WEB REFERENCES

1. www.fao.org/docrep/t4470e/t4470e08.htm

2. 3. http://www.exergy.se/goran/hig/ses/06/alternative%20fuels

http://www.alternative-energy-news.info/technology/transportation/hybrid-cars/

### SOLID WASTE MANAGEMENT

#### 15BESHOE15 COURSE OBJECTIVES:

- 1. To make the students conversant with basics of Solid wastes and its classification.
- 2. To make the student acquire sound knowledge of different treatments of solid wastes.
- 3. To acquaint the student with concepts of waste disposals.
- 4. To develop an understanding of the basic concepts of Hazardous waste managements.
- 5. To acquaint the students with the basics of energy generation from waste materials.
- 6. To get the information on energy conservation.

#### **COURSE OUTCOMES:**

- 1. Outline the basic principles of Solid waste and separation of wastes (K)
- 2. Identify the concepts of treatment of solid wastes (S)
- 3. Identify the methods of wastes disposals. (S)
- 4. Examine the level of Hazardousness and its management. (S)
- 5. Examine the possible of the energy production using waste materials. (S)
- 6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

### UNITI SOLIDWASTE

Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

### UNITII WASTETREATMENT

Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

### UNITIII WASTEDISPOSAL

Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classification, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition, Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfillRemediation

### UNITIV HAZARDOUS WASTEMANAGEMENT

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling -Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, riskassessment.

### UNITV ENERGY GENERATION FROM WASTE

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, energy recovery systems. Biological & chemical conversion technologies – Aerobic composting, low solids. Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

### TOTAL 45PERIODS

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

9

9

9

# 9

-	-				
I	1	Dara.S.S, Mishra.D.D	A Text book of Environmental chemistry and pollution control	S.Chand and company Ltd	2011

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nagpal H.Theisen, S. Vigil	Integrated Solid Waste management- Engg. Principles and management issues	George Tchobanoglous, McGraw Hill	2013
2	Frank Kreith, George Tchobanoglous	Hand Book of Solid Waste Management- 2ndedition	McGraw Hill Publishing Ltd., Newyork	2002
3	Shah, L Kanti	Basics of Solid & Hazardous Waste Management Technology	Prentice Hall	1999

#### WEB REFERENCES

www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid\_Waste.
 http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
 www.alternative-energy-news.info/technology/garbage-energy/
 nzic.org.nz/ChemProcesses/environment/

#### **15BESHOE16 COURSE OBJECTIVES:**

#### 3003100

- 1. To make the students conversant about the green chemistry
- 2. To make the student acquire sound knowledge of the atom efficient process
- Able to synthesis elaborately the atom efficient process.
- 4. To acquaint the student with concepts of green technology.
- 5. To develop an understanding of the basic concepts of renewable energy resources.
- 6. To acquaint the students with the basic information on catalysis.

#### **COURSE OUTCOMES:**

- 1. Outline the basic principles of green chemistry (K)
- 2. Examine the different atom efficient process and synthesis elaborately (S)
- 3. Apply the concepts combustion of green technology (S)
- 4. Identify and apply the concepts of renewable energy (S)
- 5. Apply the concepts of green catalysts in the synthesis (S)
- Integrate the chemical principles in the projects undertaken in field of engineering and technology (A) 6.

#### INTRODUCTION TO GREENCHEMICALPRINCIPLES UNITI

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

#### UNITII ATOM EFFICIENTPROCESSES

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis

#### UNITIII BIOTECHNOLOGY AND GREENCHEMISTRY

Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

#### UNITIV RENEWABLERESOURCES

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomassconversion

#### UNITV CATALYSIS INGREENCHEMISTRY

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

#### TOTAL 45PERIODS

#### **TEXT BOOKS**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	V. K. Ahluwalia and M.Kidwai	New Trends in Green Chemistry	Anamaya publishers.Newdelhi. Second Edition	2007
2	Sanjay K. Sharma, AckmezMudhoo	Green Chemistry for Environmental Sustainability	CRC Press	2010

# 9

9

9

9

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	K. R. Desai	Green Chemistry	Himalaya Publishing House, Mumbai.	2005
2	Dr. Sunita Ratan	A Textbook of Engineering Chemistry	S.K. Kataria and Sons	2012
3	A. S.Matlack	Introduction to Green Chemistry	Marcel Dekker: New York	2001
4	Mukesh Doble	Green Chemistry and Engineering	Academic Press	2007

- 1.
- 2.
- http://www.organic-chemistry.org/topics/green-chemistry.shtm http://www.essentialchemicalindustry.org/processes/green-chemistry.html http://www.chm.bris.ac.uk/webprojects2004/vickery/green\_solvents.htm 3.
- http://www.epa.gov/research/greenchemistry/ 4.
- 5. http://www.amazon.in/Green-Chemistry-Catalysis
# APPLIED ELECTROCHEMISTRY

### 15BESHOE17 COURSE OBJECTIVES:

- 1. To make the students conversant with the information on electrochemical material.
- 2. To make the student acquire sound knowledge of **conducting polymers**.
- 3. To acquaint the student with concepts of Energy storage devices.
- 4. To develop energy storage devices.
- 5. To impart knowledge on basic principles of solar cells
- 6. To know the applications of energy storage

# COURSE OUTCOMES:

- 1. Outline the basic principles of chemistry in electrochemical material (K)
- 2. Examine the properties of conducting polymers (S)
- 3. Apply the concepts of electrochemistry in storage devices. (S)
- 4. Identify the concepts of storage devices and its applications. (S)
- 5. Apply the suitable materials for the manufacturing of storage devices. (S)
- 6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

# UNITI METALFINISHING

Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating-Electro less plating of nickel- anodizing – Electroforming – Electro winning

# UNITII CONDUCTING POLYMERSANDELECTROCHEMICALS

Electropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers-poly acetylene-Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

# UNITIII BATTERIES ANDPOWERSOURCES-I

Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

# UNITIV BATTERIES ANDPOWERSOURCES-II

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium-Fuel cells- Introduction, types of fuel cells, advantages.

# UNITV ELECTROCHEMICALMATERIALSCIENCE

Solar cells- Preparation of CdS/Cu2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

# TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	D.Pletcher and F.C.Walsh	Industrial electrochemistry	Chapman and Hall, London	1990
2	Cynthia G. Zoski	Hand Book of Electrochemistry	Academic Press, Elesevier., UK	2007

9

9

9

9

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	M.M.Baizer	Organic electrochemistry	Dekker Inc. New York	1983
2	M. Barak	Electrochemical power sources	I.EEE series, Peter Peregrinius Ltd, Steverage, U.K.	1997
3	K.L. Chopra and I. Kaur	Thin film devices and their application	Plenum Press, New York.	1983
4	Bruno Scrosati	Applications of Electroactive polymers	Chapman & Hall, London	1993

## WEB REFERENCES

- 1. http://www.anoplate.com/finishes/
- http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
   http://inventors.about.com/od/sstartinventions/a/solar\_cell.htm

# **15BESHOE18**

## **COURSE OBJECTIVES:**

- 1. To make the students conversant with **cement and lime** and its uses.
- 2. To make the student acquire sound knowledge of abrasives
- 3. To make the student acquire sound knowledge of refractories.
- 4. To acquaint the student with concepts of inorganic chemicals.
- 5. To develop an understanding of the basic concepts of **explosives**.
- 6. To acquaint the students with the basics of **agriculture chemicals**.

## **COURSE OUTCOMES:**

- 1. Outline the basic chemistry of cement and lime (K)
- 2. Examine the uses of abrasives and refractories (S)
- 3. Identify the usage of the inorganic chemicals. (S)
- 4. Identify the concepts of explosives and smoke screens (S)
- 5. Identify the usage of the **agriculture** chemicals (S)
- 6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

# UNITI CEMENTANDLIME

Manufacture of Portland cement – settling of hardening of Portland cement – regauging cement – effect of fineness on setting and hardening – freezing – high early strength cement – high alumina cement Lime – raw materials- manufacture – slaking – lime mortar – types of lime – high – calcium or fat lime – calcium lime or lean lime – magnesian lime – dolomitic lime – hydraulic lime.

# UNITII ABRASIVES ANDREFRACTORIES

Abrasives-hardabrasives-siliceousabrasives-softabrasives-artificialabrasives-uses.Refractoriesdefinition - classification - acid refractories - basic refractories - neutral refractories - properties - uses.

# UNITIII INORGANICCHEMICALS

Common salt and soda ash – Manufacture – Different grades – products – alkalis – Na2CO3, Caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture–absorption–uses,Sulphurandsulphuricacid–extractionofsulphur–manufactureofH2SO4

- chamber - contact processes - industrialuses.

# UNITIV EXPLOSIVES

Explosives-uses-properties and tests-explosives forwar-nitrocellulose-picricacid and T.N.T.industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gasmask.

# UNITV AGRICULTURECHEMICALS

Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

# TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	B.K. Sharma	Industrial Chemistry	Goel Publishing House, Meerut	2000
2	D.Pletcher and F.C.Walsh	Industrial electrochemistry	Chapman and Hall, London	1990

### TEXTBOOKS

### 101

9

9

9

9

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	B.N.Chakrabarty	Industrial Chemistry	Oxford and IBH Publishing CO. New Delhi.	1998
2	R.N. Sherve	Chemical process industries	McGraw-Hill, Kugakuisha Ltd., Tokyo.	1984
3	James A. Kent	Hand Book of Industrial Chemistry, 9th edition	New York, Van Nostrand Reinhold.	1992
4	S.D. Shukla and G.N. Pandy	A text book of chemical technology	Vikas publishing house pvt. Ltd, New Delhi.	1979

### WEB REFERENCES

- 1. http://en.wikipedia.org/wiki/Cement
- 2. http://www.hon.ch/HONselect/Selection/D01.html
- 3. http://fas.org/man/dod-101/navy/docs/fun/part12.htm
- 4. http://toxics.usgs.gov/topics/agchemicals.html

# **PYTHONPROGRAMMING**

3003100

9

9

9

9

9

## **COURSE OBJECTIVES:**

- 1. To learn how to use and manipulate several core data structures: Lists, Dictionaries, Tuples, and Strings
- 2. To study decision structures and loops
- 3. To understand the process and skills necessary to effectively deal with problem solving in relation to writing programs
- 4. To understand the process and skills necessary to effectively deal with problem solving
- 5. To discuss in relation to writing programs
- 6. To study various program object and graphics based on python

# **COURSE OUTCOMES:**

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

- 1. Develop algorithmic solutions to simple computational problems Read, write, execute by hand simple Python programs
- 2. Structure simple Python programs for solving problems
- 3. Decompose a Python program into functions.
- 4. Represent compound data using Python lists, tuples, dictionaries
- 5. Read and write data from/to files in Python Programs
- 6. Understand various program object and graphics based on python

# UNITI FUNDAMENTALS

The Universal Machine-Program power- What is Computer Science?-Hardware Basics-Programming Languages-Python-Inside Python program-Software Development Process- Example program-Elements of programs- Output statements- Assignment Statements- Data types-Type conversions

# UNITII DECISION STRUCTURESANDLOOPS

Simple Decisions-Two-way decisions-Multi-way decisions-Exception handling-for loops-indefinite loops- common loop patterns-Booleans

# UNITIII FUNCTIONS

Function of functions-Functions and Parameters-Function that returns values-Function that modifies parameters-Functions and program structures

# UNITIV SEQUENCES

String data type- String Processing - List as sequences-String Representation-String Methods-I/O as String manipulation-File Processing

# UNITV OBJECTS ANDGRAPHICS

Overview - Object of Objects - Simple Graphics Programming - Using Graphical Objects - Choosing Coordinates - Interactive Graphics-Graphics module reference

# TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	John Zelle	Python Programming: An Introduction to Computer Science	Franklin & Associates	2009
2	Mark Lutz	Learning Python	OReily	2013

# REFERENCES

3	David Beazly& Brian K. Jones	Python Cookbook	OReily	2013
---	---------------------------------	-----------------	--------	------

9

9

9

9

9

### **COURSE OBJECTIVES:**

- 1. To study concepts of Internet, IP addresses and protocols
- 2. To explain the concept of web page development through HTML
- 3. To introduce the PERL and explore its current strengths and Weaknesses
- 4. To write working Java code to demonstrate the use of applets for client-side programming
- 5. To study Internet telephony and various multimedia applications
- 6. To Elaborate on the principles of web page development

# **COURSE OUTCOMES:**

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

- 1. Learn the advanced concepts& techniques of Internet and Java.
- 2. Analyze the requirements for and create and implement the principles of web page development
- 3. Understand the concepts of PERL
- 4. Implement client-side programming using java applets
- 5. Generate internet telephony based upon advanced concepts
- 6. Develop applications on internet programming based on java applets and scripts

# UNITIINTRODUCTION

Introduction - Network of Networks, Intranet, Extranet and Internet. World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing- Classful and Classless Addressing, Subnetting

# **UNITIIHTML**

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction- Environment Variable, GET and POST Methods.

# UNITIIIPERL

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets-Container Class, Components, Applet Life Cycle, Update method, Applications.

# UNIT IVCLIENT-SERVERPROGRAMMING

Client-Server programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

# UNIT VINTERNETTELEPHONY

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP-Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

# TOTAL 45PERIODS

# **INTERNET PROGRAMMING**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	N.P. Gopalan and J. Akilandeswari	Web Technology: A Developer's Perspective	PHI Learning, Delhi	2013
2	Rahul Banerjee	Internetworking Technologies, An Engineering Perspective	PHI Learning, Delhi	2011

# **COURSE OBJECTIVES:**

**15BECSOE03** 

- 1. To impart the fundamental concepts of Computer Animation and Multimedia
- 2. To study the graphic techniques and algorithms using flash
- 3. Explain various concepts available in 3D animation
- 4. Explain various devices available for animation
- 5. To study the multimedia concepts and various I/O technologies for concept development
- To understand the three-dimensional graphics and their transformations 6.

### **COURSE OUTCOMES**

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

- 1. Develop their creativity using animation and multimedia
- 2. Understand the concepts of Flash and able to develop animation using it
- 3. Understand about various latest interactive 3D animation concepts
- 4. Know the various devices and software available in motion capture
- 5. Understand the concept development process
- 6. Develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

#### UNITI INTRODUCTION

What is mean by Animation – Why we need Animation – History of Animation– Uses of Animation - Types of Animation - Principles of Animation - Some Techniques of Animation - Animation on the WEB – 3D Animation – Special Effects -CreatingAnimation.

**MULTIMEDIA AND ANIMATION** 

#### UNITII CREATING ANIMATIONINFLASH

Introduction to Flash Animation - Introduction to Flash - Working with the Timeline and Framebased Animation - Working with the Timeline and Tween-based Animation – Understanding Layers -Action script.

#### UNITIII **3D ANIMATION & ITSCONCEPTS**

Types of 3D Animation - Skeleton & Kinetic 3D Animation - Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.

#### **MOTIONCAPTION** UNITIV

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different Language of Script Animation Among the Software.

#### UNITV CONCEPTDEVELOPMENT

Story Developing -Audio & Video - Color Model - Device Independent Color Model - Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

# TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ranjan Parekh	Principles of Multimedia	ТМН	2007
2	Ashok Banerji, Ananda Mohan Ghosh	Multimedia Technologies	McGraw Hill Publication	2007
3	Malay K. Pakhira	Computer Graphics, Multimedia and Animation	PHI Learning	2010

# REFERENCES

9

# 9

# 9

# 9

15BECSOE03		MULTIMEDIA AND ANIMATION		3 0 0 3100
4	Pankaj Dhaka	Encyclopedia of Multimedia and Animations	Anmol Publications	2011

# **15BECSOE04** PC HARDWARE AND TROUBLE SHOOTING

# **COURSE OBJECTIVES:**

- 1. To study the basic parts of computer in detail
- 2. Introduce various peripheral devices available for computer and its detailed working concepts
- 3. Overview of various interfaces and other hardware overview
- 4. Assemble/setup and upgrade personal computer systems and discuss about power supplies and the skills to trouble-shoot various power-related problems.
- 5. To study basic concepts and methods in troubleshooting
- 6. To study the installation/connection and maintenance of computer and its associated peripherals.

# **COURSE OUTCOME:**

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

- 1. Identify the main components for the PC, familiarize themselves with PC memories such as RAM and ROM devices and so on.
- 2. Identify various peripheral devices available and its working
- 3. Understand various concepts of hardware and its interface and control
- 4. Perform basic installation of PC. Importance of maintenance is understood
- 5. Understand Various faults and failures are identified and troubleshooting in detail
- 6. Understand overall PC hardware, interfacing, maintenance and troubleshooting

# UNITI INTRODUCTION

# UNITII PERIPHERALDEVICES

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

# UNITIII PCHARDWAREOVERVIEW

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

# UNITIV INSTALLATION ANDPREVENTIVEMAINTENANCE

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – DataRecovery.

# UNITV TROUBLESHOOTING

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROMProblems.

9

# 9

9

# 9

# 15BECSOE04 PC HARDWARE AND TROUBLE SHOOTING 3 0 0 3100 TOTAL 45PERIODS

# REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	B. Govindarajalu	IBM PC Clones Hardware, Troubleshooting and Maintenance	ТМН	2002
2	Peter Abel, Niyaz Nizamuddin	IMB PC Assembly Language and Programming	Pearson Education	2007
3	Scott Mueller	Repairing PC's	РНІ	1992

### **COURSE OBJECTIVES:**

- 1. To understand the basic requirements, installation and structure of gaming using Java
- 2. Discuss various aspects of safe cracker projects
- 3. Discuss various aspects of match game projects
- 4. Discuss various aspects of pizza delivery projects
- 5. Discuss various aspects of moon landing projects
- 6. Discuss the process of development of gaming using Java

# **COURSE OUTCOMES:**

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

- 1. Interpret various concepts of gaming based on Java
- 2. Design the frame and code to develop safe cracker project
- 3. Design the frame and code to develop match game project
- 4. Design the frame and code to develop pizza delivery project
- 5. Design the frame and code to develop moon landing project
- 6. Design and develop various games using Java

# UNITI INTRODUCTION

Introducing Games with Java- Requirements-Installing Netbeans IDE-Structure of Java Program-Structure of Java GUI-Swing controls-Stopwatch Project-Creating Frames-Adding Controls-Adding Event methods-WritingCode

# UNITII SAFECRACKERPROJECT

Frame design-Grid Bag Layout Manager-Code Design-Adding Sounds-Tic Tac Toe Project-Frame Design-Code Design-Adding Events-Adding Sounds

# UNITIII MATCHGAMEPROJECT

Preview-Frame Design-Photo Selection-Code Design-Timer Objects- Adding Delays-one player Solitaire game-Computer Moves

# UNITIV PIZZADELIVERYPROJECT

Preview- Frame Design-Adding Clock-Game Design-Multiple Frames GUI- Leap Frog Project-Preview Frame Design-Code Design- Introduction to OOP-Sprite Class-Collision detection between objects- UpdatingScores

# UNITV MOONLANDINGPROJECT

Preview-Frame Design- Code Design- Graphics Methods- Graphics 2D Objects-Stroke and Paint Objects-Shapes and Drawing Methods-Line, Rectangle and Ellipse-Scrolling Background-Sprite Animation

# TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Philip Conrod, Lou Tylee	Programming Games with Java	Cengage Learning PTR	2013
2	Timothy M.Right	Fundamental 2D Game Programming with Java	Cengage Learning PTR	2015

### REFERENCES

# 9

9

9

# 9

Beil Dummes		3	Wayne Holder,Doug Bell	Java Game Programming for Dummies	Cengage Learning PTR	2013
-------------	--	---	---------------------------	--------------------------------------	----------------------	------

# ELECTRICAL AND ELECTRONICS ENGINEERING

# **15BEEEOE01**

## ELECTRICHYBRIDVEHICLES

# **Course Objectives**

- To understand the basic concepts of electric hybrid vehicle. 1.
- To gain the knowledge about electric propulsion unit. 2.
- To gain the concept of Hybrid Electric Drive-Trains. 3.
- To gain the different Energy Management Strategies. 4.
- 5. To study about the efficiency manipulation in drives
- To understand and gain the knowledge about various energy storage devices 6.

# **Course Outcomes:**

- Summarize the basic concepts in bioprocess Engineering. 1.
- Explain the concept of Hybrid Electric Vehicles. 2.
- Understand the concept of Hybrid Electric Drive-Trains. 3.
- Identify the different Energy Management Strategies. 4.
- Understand the concept of different Energy Storage devices. 5.
- Analyze the different motor drives used in Hybrid Electric Vehicles. 6.

#### UNITI INTRODUCTION

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

#### UNITII HYBRIDELECTRICDRIVE-TRAINS

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drivetrain topologies, fuel efficiency analysis.

#### UNITIII ELECTRICPROPULSIONUNIT

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

#### UNITIV **ENERGYSTORAGE**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNITV **ENERGYMANAGEMENTSTRATEGIES** 

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

> TOTAL 45PERIODS

### **TEXT BOOK**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Iqbal Hussein	Electric and Hybrid Vehicles: Design Fundamentals	CRC Press	2010

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

3003100

### 9

9

9

9

1	Mehrdad Ehsani, Yimi Gao, Gay, Ali Emadi	Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design	CRC Press	2009
2	James Larminie, John Lowry	Electric Vehicle Technology Explained	Wiley	2012

### **COURSE OBJECTIVES:**

- 1. To gain the knowledge about energy management.
- 2. To understand the basic concepts in economic analysis in energy management.
- 3. To understand the basic principles of energy audit.
- 4. To gain the knowledge about the basic concept of types of Energy Audit
- 5. To gain and Evaluate the different energy efficient motors

6. Understand the concept of Energy conservation.

### **COURSE OUTCOMES:**

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

- 1. Understand the concept of Energy Management.
- 2. Analyze the different methods for economic analysis
- 3. Knowledge about the basic concept of Energy Audit and types.
- 4. Evaluate the different energy efficient motors
- 5. Understand the concept of Energy conservation.
- 6. Investigate the different methods to improve power factor.

### UNITI ENERGYMANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting –Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

### UNITII ECONOMIC ASPECTSANDANALYSIS

Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

### UNITIII BASIC PRINCIPLES OFENERGYAUDIT

Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

### UNITIV ENERGYEFFICIENTMOTORS

Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

Energy conservation: Importance-energy saving measures in DG set-fans and blowers pumps- air conditioning systemenergy efficient transformers.

### UNITV POWER FACTOR IMPROVEMENT, LIGHTING ANDENERGYINSTRUMENTS

Power factor - methods of improvement, location of capacitors, p.f with non linear loads, effect of harmonics on p.f,- p.f motor controllers –Energy efficient lighting system design and practice- lighting control– Measuring Instruments – wattmeter, data loggers, thermocouples, pyrometers, lux meters, tong testers, application of PLCs.

TOTAL 45PERIODS

### TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Murphy W.R. and G.Mckay Butter worth	Energy Management	Heinemann Publications	2007

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	John.C.Andreas	Energy Efficient Electric Motors	Marcel Dekker Inc Ltd – 3rd edition	2005

9

9

9

9

<b>15BEEF</b>	EOE02	ENEI	RGY MANAGEMENT	& ENI	ERGY AUDITING	3 0 0 3100

2	W.C.Turner Steve Doty	Energy Management Handbook	John Wiley and Sons, 7th Edition	2013
3	Paul o' Callagham	Energy Management	Mc-Graw Hill Book Company – 1st edition	1998

# COURSE OBJECTIVES

- It deals with various types of Sensors & Transducers and their working principle
- It deals with resistive transducers
- It deals with capacitive transducers
- It deals with inductive transducers
- It deals with some of the miscellaneous transducers
- It deals with characteristics of transducers

## COURSE OUTCOMES

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

- 1. understand all types of sensors and transducers.
- 2. Justify the concept and working principle of different transducers and sensors
- 3. 3 Justify the transducers that will be utilised in the electrical industries
- 4. Identify recent developments in transducer domain
- 5. Discover the knowledge for small technology up gradations in it
- 6. Analysis the real time application.

# UNITI INTRODUCTIONOFTRANSDUCERS

Transducer - Classification of transducers - Basic requirement of transducers.

# UNITII CHARACTERISTICS OFTRANSDUCERS

Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs.

# UNITIII RESISTIVETRANSDUCERS

Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer.

# UNITIV INDUCTIVE ANDCAPACITIVETRANSDUCER

Self inductive transducer – Mutual inductive transducers– LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

# UNITV MISCELLEANEOUS TRANSDUCERS

Piezoelectrictransducer–HallEffecttransducers–Smartsensors–Fiberopticsensors–Filmsensors– MEMS – Nano sensors, Digital transducers.

# TOTAL 45PERIODS

### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sawhney A.K	A Course in Electrical and Electronics Measurements and Instrumentation	18th Edition, Dhanpat Rai & Company Private Limited	2007
2	Renganathan. S	Transducer Engineering	Allied Publishers, Chennai	2003

9

9

9

# 9

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Doebelin. E.A	Measurement Systems – Applications and Design	Tata McGraw Hill, New York	2003
2	Patranabis. D	Sensors and Transducers	Prentice Hall of India	2003
3	John. P, Bentley	Principles of Measurement Systems	III Edition, Pearson Education	2004
4	Murthy.D.V.S	Transducers and Instrumentation	Prentice Hall of India	2010

#### **PROGRAMMABLE LOGIC CONTROLLER 15BEEEOE04**

# COURSE OBJECTIVES

- To understand the basic principles of PLC systems. 1.
- To gain the knowledge about data handling functions. 2.
- 3. To gain the knowledge of storage techniques in PLC
- 4. To acquire the knowledge about how to handle the data and functions
- 5. To study about flow charts of ladder and spray process system
- 6. To understand the principles of PID.

# **COURSE OUTCOME**

- 1. At the end of the course the student will be able to understand the registers and functions in PLC and they are able to do the program.
- 2. To acquire the knowledge of storage techniques in PLC
- 3. Students know how to handle the data and functions
- 4. Students known about advanced controller in PLC applications
- 5. Students gather real time industrial application of PLC
- 6. Students gathered and evaluate the flow charts of ladder and spray process system

### UNITI INTRODUCTION

PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

### UNITII PLCPROGRAMMING

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

### **REGISTERS ANDPLCFUNCTIONS** UNITIII

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

### UNITIV DATAHANDLINGFUNCTIONS

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

#### UNITV PIDPRINCIPLES

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

# TOTAL 45PERIODS

**TEXT BOOK** 

S.	Author(s) Name	Title of the book	Publisher	Year of
No.	Author (s) Manie	The of the book	i ublisher	Publication

9

9

9

9

15BE	EEOE04 P	<b>ROGRAMMABLE LOGIC CO</b>	ONTROLLER	3 0 0 3100
1	JR Hackworth and F.D Hackworth – Jr	Programmable Logic Controllers – Programming Method and Applications	Pearson	2006

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	John Webb and Ronald A Reiss	Programmable Logic Controllers – Principle and Applications	Fifth edition, PHI	2004
2	W.Bolton	Programmable Logic controller	Elsevier Newnes Publications, Fourth Edition	2009

### WEB REFERENCE

1. http://www.mikroe.com/old/books/plcbook/chapter1/chapter1.htm, - Introduction to programmable Logic controller

# **RENEWABLE ENERGY RESOURCES**

# COURSE OBJECTIVES

**15BEEEOE05** 

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion. •
- To study about solar energy collectors and its storages
- To study about the inter connected system in wind power
- To understand the basic principles fuel cell, Geo thermal power plants. ٠
- To gain the knowledge about hydro energy.

# **COURSE OUTCOMES**

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

- 1. Analyze the Energy Scenario in India
- 2. Understand the concept of Solar Energy
- 3. Understand the concept of Wind Energy
- 4. Understand the concept of Hydro Energy
- 5. Analyze the different energy sources
- 6. Students gathered the real time inter connected system modelling in wind power

### UNITI INTRODUCTION

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

### UNITII SOLARENERGY

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage - solar cells and photovoltaic conversion - PV systems - MPPT. Applications of PV Systems – solar energy collectors and storage.

### UNITIII WINDENERGY

Introduction - Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation - generator control, load control, energy storage - applications of wind energy - Inter connected systems.

### UNITIV HYDROENERGY

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

### UNITV OTHERSOURCES

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

# TOTAL 45PERIODS

**TEXTBOOKS** 

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rai.G.D	Non-conventional resources of energy	Khanna publishers ,Fourth edition	2011

# 9

9

9

# 9

15BEEEOE05		EEOE05	RENEWABLE ENERGY RESOURCES		3 0 0 3100
	2	Khan.B.H	Non-Conventional Energy Resources	The McGraw Hills, Second edition	2009

# REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rao.S. &Parulekar	Energy Technology	Khanna publishers, Fourth edition	2013
2	Godfrey Boyl	Renewable Energy: Power sustainable future	Oxford University Press, Third edition	2012
3	John W Twidell and Anthony D Weir	Renewable Energy Resources	Taylor and Francis	2015
4	Mittal K.M	Non-Conventional Energy Systems	Wheeler Publishing Co. Ltd	1997

### WEB REFERENCE

www.energycentral.com
 www.catelelectricpowerinfo.com

### **COURSE OBJECTIVES:**

- 1. To study the state variable analysis
- 2. To provide adequate knowledge in the phase plane analysis and also describing function analysis.
- 3. To study the analysis discrete time systems using conventional techniques.
- 4. To analyze the stability of the systems using different techniques.
- 5. To study the design of optimal controller.
- 6. To study the types of compensators

### **COURSE OUTCOMES:**

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

- 1. understand the state variable analysis, Z- transform, state equation
- 2. Construct the frequency response of the system using various plots
- 3. Correlate the time and frequency domain specifications and
- 4. Correlate the effect of compensation
- 5. Design the different types of compensators using frequency response plots to stabilize the control system
- 6. Explain the state variable representation of physical systems with the effects of state feedback its assessment for linear-time invariant systems.

### UNITI STATEVARIABLEANALYSIS

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability - Pole Placement –State observer Design of Control Systems with observers

## UNITII PHASE PLANE AND DESCRIBINGFUNCTIONANALYSIS

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Construction of phase portraits – Singular points – Limit cycles Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

### UNITIII Z-TRANSFORM AND DIGITALCONTROLSYSTEM

Z transfer function - Block diagram - Signal flow graph - Discrete root locus - Bode plot.

### UNITIV STATE-SPACE DESIGN OF DIGITALCONTROLSYSTEM

State equation - Solutions - Realization - Controllability - Observability - Stability - Jury's test.

### UNITV OPTIMALCONTROL

 $Introduction \ -Decoupling \ - \ Time \ varying \ optimal \ control \ - \ LQR \ steady \ state \ optimal \ control \ - \ Optimal \ estimation \ - \ Multivariable \ control \ design.$ 

### TOTAL 45PERIODS

### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	I.J. Nagrath and M. Gopal	Control Systems Engineering	New Age International Publishers	2003
2	Ashish Tewari	Modern control Design with Matlab and Simulink	John Wiley, New Delhi	2002
3	Benjamin C. Kuo	Digital Control Systems	Oxford University Press	1992
4	George J. Thaler	Automatic Control Systems'	Jaico Publishers	1993

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

9

9

# 9

9

#### CONTROL SYSTEMS 3 0 0 3100 FEFORA 15**B** . MA n

BE	EEOE06	ADVANCED CONTROL S	SYSTEMS	3003100
1	George J. Thaler	Automatic Control Systems	Jaico Publishers	1993
2	M.Gopal	Modern control system theory	New Age International Publishers	2002
3	Gene F. Franklin, and Abbasemami-Naeini	Feedback Control of Dynamic Systems	Fourth edition, Pearson Education, Low price edition	2002
4	Raymond T. Stefani & Co	Design of feedback Control systems	Oxford University	2002

# **ELECTRONICS AND COMMUNICATION ENGINEERING**

# 15BEECOE01

# **REAL TIMEEMBEDDEDSYSTEMS**

### **COURSE OBJECTIVES**

- 1. To introduce students to the embedded systems, its hardware and software.
- 2. To introduce devices and buses used for embedded networking.
- 3. To study about task management
- 4. To learn about semaphore management and message passing
- 5. To study about memory management
- 6. To imparts knowledge on

## COURSE OUTCOMES

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

- 1. Understand overview of embedded systems architecture
- 2. Acquire knowledge on embedded system, its hardware and software.
- 3. Gain knowledge on overview of Operating system
- 4. Discuss about task Management
- 5. Gain knowledge about semaphore management and message passing.
- 6. Gain knowledge about memory management.

### UNITI INTRODUCTION TO EMBEDDEDSYSTEM

Introduction - Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture (CISC and RISC) - Categories of Embedded Systems - embedded processor selection & tradeoffs - Embedded design life cycle - Product specifications - hardware/software partitioning - iterations and implementation - hardware software integration - product testing techniques – ARM 7

### UNITII OPERATINGSYSTEMOVERVIEW

Introduction –Advantage and Disadvantage of Using RTOS – Multitasking – Tasks - Real Time Kernels – Scheduler - Non-preemptive Kernels - Preemptive Kernels – Reentrancy- Reentrant Functions – Round Robin Scheduling - Task Priorities - Static Priorities – Mutual Exclusion – Deadlock – Intertask Communication – Message Mailboxes – Message Queues - Interrupts - Task Management – Memory Management - Time Management – Clock Ticks.

### UNITIII TASKMANAGEMENT

 $\begin{array}{l} Introduction - \mu C/OS-II \ Features - \ Goals \ of \ \mu C/OS-II \ - \ Hardware \ and \ Software \ Architecture - \ Kernel \ Structures: \ Tasks \ -Task \ States - \ Task \ Scheduling \ - \ Idle \ Task \ - \ Statistics \ Task \ - \ Interrupts \ Under \ \mu C/OS-II \ - \ Clock \ Tick \ - \ \mu C/OS-II \ Initialization. \ Task \ Management: \ Creating \ Task \ - \ Task \ Stacks \ - \ Statk \ Stacks \ - \ Statk \ Stacks \ - \ Statk \ Statks \ - \ Task \ Statks \ - \ Statks \ - \ Statks \$ 

### UNITIV SEMAPHORE MANAGEMENT ANDMESSAGEPASSING

Semaphore Management: Semaphore Management Overview – Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox – Deleting Mailbox – Waiting for a Message box – Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue – Deleting a Message Queue – Waiting for a Message at a Queue – Sending Message to a Queue – Flushing a Queue.

### UNITV MEMORYMANAGEMENT

Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memory Block – Returning a Memory Block .Getting Started with  $\mu$ C/OS-II – Installing  $\mu$ C/OS-II – Porting  $\mu$ C/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with  $\mu$ C/OS-II –  $\mu$ C/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Analyze the Multichannel ADC with help of  $\mu$ C/OS-II.

### TOTAL 45PERIODS

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jean J. Labrosse	MicroC/OS – II The Real Time Kernel	CMP BOOKS	2009
2	David Seal	ARM Architecture Reference Manual.	Addison-Wesley	2008

3 0 0 3100

**9** m

9

# 9

9

q

3	Steve Furbe,	ARM System-on-Chip Architecture,	Addison-Wesley Professional, California	2000
---	--------------	----------------------------------	--	------

## **COURSE OBJECTIVES**

- 1. To study about various speakers and microphone
- 2. To learn the fundamental of television systems and standards
- 3. To learn the process of audio recording and reproduction
- 4. To study various telephone networks
- 5. To discuss about the working of home appliances
- 6. To familiarize with TV services like ISDN.

# **COURSE OUTCOMES**

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

- 1. Understand working of various type of loud speakers
- 2. Acquire knowledge on various types of picture tubes
- 3. Demonstrate the working of various optical recording systems
- 4. Distinguish various standards for color TV system
- 5. Acquire knowledge on various telecommunication networks
- 6. Demonstrate the working of various home appliances

# UNITI LOUDSPEAKERS ANDMICROPHONES

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

# UNITII TELEVISION STANDARDSANDSYSTEMS

Components of a TV system – interlacing – composite video signal. Colour TV – Luminance and Chrominance signal; Monochrome and Colour Picture Tubes - Colour TV systems – NTSC, PAL, SECAM - Components of a RemoteControl.

# UNITIII OPTICAL RECORDINGANDREPRODUCTION

AudioDisc–ProcessingoftheAudiosignal–readoutfromtheDisc–Reconstructionoftheaudiosignal– Video Disc – Video disc formats- recording systems – Playback Systems.

# UNITIV TELECOMMUNICATIONSYSTEMS

Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellularmodems

# UNITV HOMEAPPLIANCES

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

TOTAL 45PERIODS

### TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	S.P.Bali	Consumer Electronics	Pearson Education	2005

9

9

9

9

# 15BEECOE03 FUNDAMENTALS OF NANOTECHNOLOGY

# **COURSE OBJECTIVES**

- 1. Tofamiliar with the important concepts applicable tosmall electronic devices, their fabrication, characterization and application
- 2. To have a solid understanding of Nanotechnology concepts.
- 3. To introduce the basic concepts of Nanotechnology and its applications in various domain
- 4. To understand the molecular structure of carbon nano tube
- 5. To educate how to use Nanotechnology to solve real-world problems
- 6. To familiar with the structure and application of carbon nano tube

# COURSE OUTCOMES

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

- 1. Understand the basic concepts of Nanotechnology and its applications in various domain
- 2. Ability to develop how to use Nanotechnology to solve real- world problems
- 3. Understand solid understanding of Nanotechnology concepts
- 5. Understand the molecular structure of carbon nano tube
- 6. Familiar with the structure and application of carbon nano tube

# UNITI LIMITATIONSOFCMOS

FundamentalsofMOSFETdevices-ScalingofCMOS–Limitations–Alternativeconceptsinmaterials– Structures of MOS devices: SOI MOSFET, FINFETS, Dual Gate MOSFET, Ferro electric FETs.

# UNITII MICRO AND NANOFABRICATION

Optical Lithography – Electron beam Lithography – Atomic Lithography – Molecular beam epitaxy - Nano lithography.

# UNITIII CHARACTERIZATIONEQUIPMENTS

Principles of Electron Microscopes – Scanning Electron Microscope – Transmission Electron Microscope - Atomic Force Microscope – Scanning Tunneling Microscope.

# UNITIV NANO DEVICES – I

Resonant tunneling diodes – Single electron devices – Josephson junction – Single Flux Quantum logic–

Molecular electronics.

# UNITV NANO DEVICES – II

Quantum computing: principles – Qbits – Carbon nanotubes (CNT): Characteristics, CNTFET, Application of CNT - Spintronics: Principle, Spin valves, Magnetic Tunnel Junctions, SpinFETs, MRAM

# TOTAL 45PERIODS

# TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rainer Waser (Ed)	Nano electronics and information technology	Wiley- VCH. 3rd Edition	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

9

9

# 9

# 9

 15BEECOE03		FUNDAMENTALS OF NANOTECHNOLOGY		3 0 0 3100
1	Thomas Heinzel	A Microscopic Electronics in Solid State Nanostructure	Wiley- VCH	2008
2	Mick Wilson,	Nanotechnology – (Basic Science and Emerging Technologies	Overseas Press	2002
3	Mark Ratner, Daniel Ratner	Nanotechnology: A Gentle introduction to the Next Big idea	Pearson education	2003

### **COURSE OBJECTIVES**

- 1. To stud y the image fundamentals and mathematical transforms necessary for image processing.
- 2. To study the image enhancement techniques
- 3. To study the image compression procedures.
- 4. To study the image segmentation and representation techniques.
- 5. To study the video processing fundamentals
- 6. To know the concepts of motion estimation

### **COURSE OUTCOMES:**

- 1. Understand the image fundamentals and mathematical transforms necessary for image processing.
- 2. Understand the image enhancement techniques
- 3. Understand the image compression procedures.
- 4. Understand the image segmentation and representation techniques.
- 5. Understand the video processing fundamentals
- 6. Understand motion estimation concepts

# UNITI FUNDAMENTALS OF IMAGE PROCESSING ANDIMAGETRANSFORMS

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet transforms.

### UNITII IMAGEPROCESSINGTECHNIQUES

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters, Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.

## UNITIII IMAGE SEGMENTATIONANDCOMPRESSION

Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.

### UNITIV BASICS OF VIDEOPROCESSING

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filteringoperations.

## UNITV 2-DMOTIONESTIMATION

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TOTAL 45PERIODS

### TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gonzaleze and Woods	Digital Image Processing	Pearson	2012
2	Yao wang, and Ya – quinZhang	Video processing and communication	PHI	2013

### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

9

9

9

### 9

**15BEECOE04** 

# IMAGE &VIDEO PROCESSING

1	M. Tekalp	Digital video Processing	Prentice ll International	2011
2	Aner ozdemi R	Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms	JohnWiley& Sons	2012
3	Chris Solomon, Toby Breckon	Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab	JohnWiley& Sons	2000

## **Course Objectives**

- 1. To learn the processing steps in fabrication of VLSI devices.
- 2. To learn the concepts of assembling and packaging for VLSI devices.
- 3. To imparts a good knowledge in reactive plasma etching techniques and equipment.
- 4. To familiarize the students with the NMOS and CMOS IC technology.
- 5. To make the student acquire reactive Plasma Etching techniques and Equipment.
- 6. To acquaint the student with the VLSI assembly technology and package fabrication technology

VLSI TECHNOLOGY

### Course outcomes

After completing this course, the students will be able to

- 1. List out various fabrication techniques
- 2. Understand the etching principle in IC fabrication
- 3. Gain knowledge on deposition and diffusion methods
- 4. Understand the process simulation and integration.
- 5. Assembling and packing techniques
- 6. various technologies used for fabricating VLSI devices

# **UNIT 1 INTRODUCTION TOMOS TECHNOLOGIES**

MOS, CMOS, BiCMOS Technology, Trends and Projections. Basic Electrical Properties of MOS, CMOS &BiCMOS Circuits: Ids-Vds relationships, Threshold Voltage Vt, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

# UNIT II LAYOUT DESIGNANDTOOLS

Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. Logic Gates & Layouts: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

# UNIT III COMBINATIONALLOGICNETWORKS

Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Networktesting.

# UNIT IVSEQUENTIALSYSTEMS

Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.

# **UNIT V FLOOR PLANNING & ARCHITECTUREDESIGN**

Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.

# TOTAL 45PERIODS

Voor of

No.	Author(s) Name	Title of the book	Publisher	Publication
1	K. Eshraghian, Eshraghian. D	Essentials of VLSI Circuits and Systems	PHI	2005
2	Wayne Wolf	Modern VLSI Design	Pearson Education	1997

### TEXT BOOK

S

# 9

# 9

9

# 9

# 15BEECOE05

# **VLSI TECHNOLOGY**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	N.H.EWeste, K.Eshraghian	Principals of CMOS VLSI Design	Adisson Wesley	2005

### **Course Objectives**

- 1. To study materials used for MEMS and its working
- 2. To study the fabrication process used for MEMS
- 3. To study the packaging process used for MEMS
- 4. To familiarize the students with various micro actuators and micro sensors.
- 5. To learn the survey of materials central to micro engineering.
- 6. To imparts good knowledge in micro system packaging materials

### **Course Outcomes**

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

- 1. Appreciate the underlying working principles of MEMS devices.
- 2. Understand the working of Micro sensors and actuators
- 3. Explain the IC fabrication processes
- 4. Gain knowledge on bulk manufacturing
- 5. Understand the Design of Micro systems.
- 6. Design and model MEMS devices.

# UNITI INTRODUCTION TO MEMS ANDMICROFABRICATION

History of MEMS Development, Characteristics of MEMS-Miniaturization - Microelectronics integration - Mass fabrication with precision. Sensors and Actuators- Energy domain. Sensors, actuators Micro fabrication - microelectronics fabrication process- Silicon based MEMS processes- New material and fabrication processing- Points of consideration for processing. Anisotropic wet etching, Isotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), and Surface micromachining process- structural and sacrificial material.

## UNITII ELECTRICAL AND MECHANICAL CONCEPTSOFMEMS

Conductivity of semiconductors, crystal plane and orientation, stress and strain - definition - Relationship between tensile stress and strain- mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam- longitudinal strain under pure bending -deflection of beam- Spring constant, torsional deflection, intrinsic stress, resonance and qualityfactor.

### UNITIII ELECTROSTATIC AND THERMAL PRINCIPLE SENSINGANDACTUATION

Electrostatic sensing and actuation-Parallel plate capacitor - Application- Inertial, pressure and tactile sensor parallel plate actuator- comb drive Thermal sensing and Actuations-Thermal sensors-Actuators- Applications Inertial, flow and infraredsensors.

### UNITIV PIEZORESISTIVE, PIEZOELECTRIC AND MAGNETICPRINCIPLESENSORS

### AND ACTUATOR

Piezoresistive sensors- piezoresistive sensor material- stress in flexural cantilever and membrane- Application- Inertial, pressure, flow and tactile sensor.Piezoelectric sensing and actuation- piezoelectric material properties- quartz- PZT-PVDF - ZnO- Application-Inertial, Acoustic, tactile, flow-surface elastic waves Magnetic actuation- Micro magnetic actuation principle- Deposition of magnetic materials-Design and fabrication of magneticcoil.

### UNIT V POLYMER ANDOPTICALMEMS

Polymers in MEMS- polymide-SU-8 Liquid crystal polymer(LCP) - PDMS – PMMA – Parylene - Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMS-passive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.

TOTAL 45PERIODS

### TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Chang Liu	Foundations of MEMS	Pearson Indian Print, 1 <sup>st</sup> Edition	2012

9

9

9

9
#### **FUNDAMENTALS OF MEMS**

#### 15BEECOE06 REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gaberiel M. Rebiz	RF MEMS Theory, Design and Technology	John Wiley & Sons	2003
2	Charles P. Poole and Frank J. Owens	Introduction to Nanotechnology	John Wiley & Sons	2003
3	Julian W.Gardner and Vijay K Varadhan	Microsensors, MEMS and Smart Devices	John Wiley & sons	2001

#### 15BEECOE07 NEURAL NETWORKS AND ITS APPLICATIONS

#### **Course Objectives**

- 1. To introduce the basic concepts of neural networks and its applications in various domain
- 2. To educate how to use Soft Computing to solve real-world problems
- 3. To have a solid understanding of Basic Neural Network.
- 4. To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
- 5. To gain exposure in the field of neural networks and relate the human neural system into the digital world
- 6. To provide knowledge of computation and dynamical systems using neural networks

#### **Course Outcomes**

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

- 1. Understand the basic concepts of neural networks and its applications in various domains
- 2. Gain knowledge about learning process in Neural Networks
- 3. Apply perception concept in design
- 4. Design using ART phenomena
- 5. Gain knowledge on SOM concepts
- 6. Ability to develop the use of Soft Computing to solve real-world problems

## UNITI INTRODUCTION TO NEURALNETWORKS

Introduction - biological neurons and their artificial models - learning, adaptation and neural network's learning rules - types of neural networks- single layer, multiple layer- feed forward, feedback networks

## UNITII LEARNINGPROCESS

Error – correction learning – memory based learning - hebbian learning-competitive learning-Boltzmann learning- supervised and unsupervised learning-adaptation-statistical learning theory.

## UNITIII PERCEPTION

Single layer perception-Adaptive filtering-unconstrained optimization-Least-mean square algorithm-Leaning curve-Annealing Technique-perception convergence theorem-Relationship between perception and Baye's classifier-Back propagation algorithm

## UNITIV ATTRACTOR NEURAL NETWORKANDART

Hopfield model-BAM model-BAM stability-Adaptive BAM -Lyapunov function-effect of gain-Hopfield design-Application to TSP problem-ART- layer 1-layer 2-orienting subsystem- ART algorithm-ARTMAP

## UNITV SELFORGANIZATION

Self organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical vector Quantization. Applications of self-organizing maps: The Neural Phonetic Typewriter Learning Ballistic Arm Movements

## TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Simon Haykin	Neural Networks and Learning Machines	Pearson/ Prentice Hall	2009
2	Satish Kumar	Neural Networks - A Classroom Approach	ТМН	2008
3	Freeman J.A., Skapura D.M	Neural networks, algorithms, applications, and programming techniques	Addition Wesley	2005

#### REFERENCES

## 9

9

9

9

<b>15BEECOE07</b>		ECOE07	NEURAL NETWORKS AND IT	3003100	
	4	Laurene Fausett	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications	Pearson/ Prentice Hall	1997

\_

#### **FUZZY LOGIC AND ITS APPLICATIONS 15BEECOE08**

#### **COURSE OBJECTIVES**

- 1. To introduce the basic concepts of Fuzzy logic and its applications in various domain
- 2. To educate how to use Fuzzy computation to solve real-world problems
- 3. To have a solid understanding of Basic fuzzy models.
- 4. Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- 5. To learn about applications on Fuzzy based systems
- 6. To familiarize with fuzzy fiction and de fuzzy fiction procedures

#### **COURSE OUTCOMES**

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

- 1. Understand the basic concepts of Fuzzy logic and its applications in various domain
- 2. Gain knowledge on theory of Reasoning
- 3. Develop fuzzy controllers
- 4. Understand concepts of adaptive fuzzy control
- 5. Ability to develop how to use Fuzzy computation to solve real- world problems
- 6. Design fuzzy based model for any application

#### UNITI BASICS OFFUZZYLOGIC

Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

#### UNITII THEORY OF APPROXIMATEREASONING

Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference-fuzzy models

#### UNITIII FUZZY KNOWLEDGE BASEDCONTROLLERS(FKBC)

Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures – Design of Fuzzy Logic Controller

#### UNITIV ADAPTIVEFUZZYCONTROL

Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

#### UNITV FUZZYBASEDSYSTEMS

Simple applications of FKBC -washing machines- traffic regulations -lift control-fuzzy in medical applications- Introduction to ANFIS.

## TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	D. Diankar, H. Hellendoom	An Introduction to Fuzzy Control	Narosa Publishers India	1996
2	G. J. Klir and T. A. Folger	Fuzzy Sets Uncertainty and Information	PHI IEEE	1995

9

9

9

### 9

#### **BIOTECHNOLOGY**

#### **15BTBTOE01**

#### BIOREACTORDESIGN

#### **COURSE OBJECTIVES:**

- 1. To impart basic knowledge in bioprocessEngineering
- 2. To design the bioreactors for variousoperations.
- 3. To understand the principle and working of heat transferequipments.
- 4. To extend the knowledge in principle of heat transfer inside abioreactor
- 5. To construct the equipments used in mass transferoperations.
- 6. To learn the equipments used in separationprocess.

#### **COURSE OUTCOMES:**

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

- 1. Summarize the basic concepts in bioprocessEngineering.
- 2. Design the bioreactors for variousoperations.
- 3. Understand the principle and working of heat transferequipments.
- 4. Develop the heat transfer equipments for BioprocessEngineering.
- 5. Construct the equipments used in mass transferoperations.
- 6. Categorize the equipments used in separationprocess.

## UNITI ENGINEERING PROPERTIES ANDSTORAGETANK

Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

## UNITII REACTORDESIGN

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

## UNITIII HEATTRANSFEREQUIPMENTS

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulationevaporator.

## UNITIV MASS TRANSFEREQUIPMENTS

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

## UNITV SEPERATIONEQUIPMENTS

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson –walker crystallizer.

## TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	James Edwin Bailey, David F. Ollis	Biochemical Engineering Fundamentals	McGraw- Hill	2007
2	Don W. Green, Robert H. Perry	Chemical Engineer Hand book	The McGraw- Hill Companies, Inc.	2008

REFERENCE

9

9

9

9

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Pauline. M. Doran	Bioprocess Engineering Principles	Academic Press	2013

## 15BTBTOE02 FOOD PROCESSING AND PRESERVATION

### **COURSE OBJECTIVES**

- 1. To learn the scope and importance of foodprocessing.
- 2. To impart basic knowledge in different food processing methods carried out in the food techcompanies.
- 3. To extend the brief knowledge in food conservationoperations.
- 4. To study the methods of food preservation bycooling.
- 5. To familiarize the students on the concepts of preservation methods forfruits.
- 6. To create deeper understanding on preservation methods forvegetables.

## **COURSE OUTCOMES**

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

- 1. Describe the scope and importance of foodprocessing.
- 2. Outline the various processing methods forfoods.
- 3. Extend the knowledge in food conservationoperations.
- 4. Describe the methods of food preservation bycooling.
- 5. Summarize the preservation methods forfruits.
- 6. Demonstrate the preservation methods forvegetables.

## UNITI SCOPE AND IMPORTANCE OFFOODPROCESSING

Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

## UNITII PROCESSINGMETHODS

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning- additives fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing- Concepts and equipmentused.

## UNITIII FOODCONVERSIONOPERATIONS

Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments- membrane separation- filtration- equipment and application.

## UNITIV FOOD PRESERVATIONBYCOOLING

Refrigeration, Freezing-Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control wateractivity.

## UNITV PRESERVATION METHODS FOR FRUITSANDVEGETABLES 9

Pre processing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar

- Heat preservation- Food irradiation- Combined preservation techniques.

## TOTAL 45PERIODS

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

9

9

## 9

15BT	BTOE02 FO	OOD PROCESSING AND PRI	ESERVATION	3 0 0 3100
1	R. Paul Singh, Dennis R. Heldman	Introduction to food engineering.	Academic Press	2001
2	P.Fellows.	Food Processing Technology, Principles and practice.	Wood head Publishing Ltd	2000
3	Mircea EnachescuDauthy	Fruit and Vegetable Processing	FAO agricultural services bulletin no.119	1995

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	M.A. Rao, Syed S.H. Rizvi, Ashim K. Datta	Engineering properties of foods	CRC Press	2005
2	B. Sivasankar	Food processing and preservation	PHI Learning Pvt. Ltd	2002

#### **15BTBTOE03**

#### **COURSE OBJECTIVES**

- 1. To understand the theoretical foundation of computational chemistry, with an emphasis on electronic structure calculations using quantum chemistry and classical molecular dynamics simulation techniques
- 2. To use computational chemistry software to simulate chemical processes, quantify and rationalise reactivity.
- 3. To study reaction mechanisms, relative free energies and structural dynamics
- 4. To compute different experimental properties and spectra using computational techniques.
- 5. To understand how to construct, interpret and utilise potential energy surfaces.
- 6. To understand the theoretical and practical challenges associated with computational modeling.

#### COURSE OUTCOMES

- 1. Understand the theoretical foundation of computational chemistry, with an emphasis on electronic structure calculations using quantum chemistry and classical molecular dynamics simulation techniques
- 2. Can use computational chemistry software to simulate chemical processes, quantify and rationalise reactivity.
- 3. Study reaction mechanisms, relative free energies and structural dynamics
- 4. Compute different experimental properties and spectra using computational techniques.
- 5. Understand how to construct, interpret and utilise potential energy surfaces.
- 6. Understand the theoretical and practical challenges associated with computational modeling.

## UNITI MOLECULARMODELLING

Introduction to concept of molecular modeling, molecular structure and internal energy, applications of molecular graphics, coordinate systems, potential energy surfaces, discussion of local and global energy minima

## UNITII QUANTUM MECHANICS

Introduction to the computational quantum mechanics; one electron atom, ply electronic atoms and molecules, Hartree Fock equations; calculating molecular properties using ab initio and semi empirical methods.

## UNITIII MOLECULARMECHANICS

Molecular mechanics; general features of molecular mechanics force field, bond stretching, angle bending, torsional terms, non – bonded interactions; force field parameterization and transferability; energy minimization; derivative and non – derivative methods, applications of energy minimization.

## UNITIV MOLECULARDYNAMCS

Molecular dynamics simulation methods; molecular dynamics using simple models, molecular dynamics with continuous potential, setting up and running a molecular dynamic simulation, constraint dynamics; Monte Carlo simulation; Monte Carlo simulation of molecules.

## UNITV MODELLING ANDDRUGDESIGN

Macromolecular modeling, design of ligands for known macro molecular target sites, Drug- receptor interaction, classical SAR /QSAR studies and their implications to the 3 D modeler, 2-D and 3-D database searching, pharmacophore identification and novel drug design, molecular docking, Structure-based drug design for all classes of targets.

## TOTAL 45PERIODS

#### TEXTBOOKS

9

9

9

## 9

#### **15BTBTOE03**

#### **MOLECULAR MODELING**

3	0	0	31	00
0	υ	υ	<b>J</b>	υu

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Andrew Leach	Molecular Modelling: Principles and Applications	Prentice Hall	2001
2	N. Claude Cohen	Guidebook on Molecular Modeling in Drug Design	Academic Press	1996

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Yvonne C. Martin, Peter Willett	Designing bioactive molecules :three- dimensional techniques and applications	Washington, DC : American Chemical Society	1998
2	Matthew F. Schlecht	Molecular Modeling on the PC	Wiley- Blackwell; Har	1998

#### **COURSE OBJECTIVES**

- 1. To understand the basics ofbiology
- 2. To gain knowledge about differentbiomolecules
- 3. To get familiarize with humandiseases.
- 4. To learn about DNA & RNA.
- 5. To learn about different clinicalinvestigations
- 6. To know the recent advances inbiology

#### **COURSE OUTCOMES**

At the end of the course

- 1. Summarize the cell structures and itsfunctions
- 2. Explain the Biomolecules functions
- 3. Classify the communicable and non-communicable humandiseases
- 4. Illustrate the different organ functiontests
- 5. Tell the applications of biology in environmental applications
- 6. Describe the concept ofbiomechanics

## UNITI OVERVIEW OFBIOREMEDIATION

Pollution: Types and its consequences, History of bioremediation, Sources of contamination, Bioremediation processes, Environments where bioremediation is used, Microbiology of bioremediation.

**BIOREMEDIATION** 

## UNIT II BIOFILM PROCESSES

Trickling Filters and Biological Towers, Rotating Biological Contactors, Granular Media

Filters, Fluidized-bed Reactors, Hybrid Biofilm Processes

## UNITIII BIOREMEDIATION FORSOILENVIRONMENT

Environment of Soil Microorganisms, Soil Organic Matter and Characteristics, Soil Microorganisms Association with Plants, Pesticides and Microorganisms, Petroleum Hydrocarbons and Microorganisms, Industrial solvents and Microorganism, Biotechnologies for Ex-Situ Remediation & in-Situ Remediation of Soil Phytoremediation Technology for Soil Decontamination

## UNITIV BIOREMEDIATION FOR AIR ANDWATERENVIRONMENT 9

Atmospheric Environment for Microorganisms, Microbial Degradation of Contaminants in Gas Phase, Biological Filtration Processes for Decontamination of Air Stream-Biofiltration, Biotrickling Filtration, Bioscrubbers, Contaminants in Groundwater, Landfill Leachate Biotreatment Technologies, Industrial Wastewater Biotreatment Technologies, Biotreatment of Surface Waters

## UNITV BIOREMEDIATIONOFMETALS

Microbial Transformation of Metals, Biological Treatment Technologies for Metals Remediation, Bioleaching and Biobenificiation, Bioaccumulation, Oxidation/Reduction Processes, Biological Methylation

## TOTAL 45PERIODS

## **9** 15

## 9

9

#### **15BTBTOE04**

## BIOREMEDIATION

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rittmann, B.E., and McCarty, P.L.,	Environmental Biotechnology: Principles and Applications.	McGraw Hill,	2001
2	John Cookson	Bioremediation Engineering: Design and Applications	McGraw- Hill Education	1995

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Prescott, L. M., Harley, and Klein, D. A	Microbiology	McGraw- Hill Higher Education	2008

**BIOPHYSICS** 

#### **COURSE OBJECTIVES**

- 1. To study selected biological phenomena using physical principles.
- 2. To understand the biological and environmental sciences.
- 3. To gain the knowledge on technical enormous impact of the biological sciences.
- 4. To acquire the knowledge about molecular structure of biological systems.
- 5. To know the uses of proteins and its functions.
- 6. To understand the biological structure & function: Size and shape of macromolecules.

#### **COURSE OUTCOMES**

- 1. Study selected biological phenomena using physical principles.
- 2. Understand the biological and environmental sciences.
- 3. Gain the knowledge on technical enormous impact of the biological sciences.
- 4. Acquire the knowledge about molecular structure of biological systems.
- 5. Know the uses of proteins and its functions.
- 6. Understand the biological structure & function: Size and shape of macromolecules.

## UNITI MOLECULAR STRUCTURE OFBIOLOGICALSYSTEMS

 $Intramolecular \ bonds-covalent-ionic \ and \ hydrogen \ bonds-biological \ structures \ -general \ features \ -water \ structure-hydration-interficial \ phenomena \ and \ membranes-self \ assembly \ and \ molecular \ structure \ of \ membranes.$ 

## UNITII CONFORMATION OFNUCLEICACIDS

Primary structure – the bases – sugars and the phosphodiester bonds- double helical structure – A, B and Z forms – properties of circular DNA – topology – polymorphism and flexibility of DNA – structure of ribonucleic acids – hydration of nucleic acids.

## UNITIII CONFORMATIONOFPROTEINS

Conformationofthepeptidebond–secondarystructures–ramachandranplots–useofpotentialfunctions–tertiary structure – folding – hydration of proteins – hydropathy index.

## UNITIV ENERGETICS & DYNAMICS OF BIOLOGICALSYSTEMS

Kinetics of ligand interactions; Biochemical kinetics studies, uni-molecular reactions, simple bi molecular multiple intermediates, steady state kinetics, catalytic efficiency, relaxation spectrometry, ribonuclease as an example.

## UNITV APPLIEDTECHNIQUES

Techniques for the study of biological structure & function: Size and shape of macromolecules – methods of direct visualization macromolecules as hydrodynamic particles – macromolecules diffusion – ultra centrifugation – viscometry x-ray crystallography determination of molecular structures, X-ray fibre diffusion electron microscopy neutron scattering – light scattering.

## TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Roland Glaser	Biophysics	Springer Science & Business Media	2001

9

9

9

9

<b>15BTBTOE05</b>		BTOE05	BIOPHYSICS		3 0 0 3100
	2	Michel Daune	Molecular Biophysics: Structures in Motion	Oxford University Press	1999

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Charles R. Cantor	Biophysical Chemistry, Part 2: Techniques for the Study of Biological Structure and Function	W.H. Freeman and Company	1980

#### **15BTBTOE06**

#### **COURSE OBJECTIVES**

- 1. To understand the available tools and databases for performing research inbioinformatics.
- 2. To expose students to sequence alignment tool inbioinformatics.
- 3. To construct the phylogenetic trees forevolution.
- 4. To get familiar with the 3D structure of protein and classification.
- 5. To acquire basic knowledge in protein secondary structureprediction.
- 6. To extend the brief knowledge in Micro array dataanalysis.

#### COURSE OUTCOMES

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

- 1. Summarize the basic concepts and importance of Bioinformatics in varioussectors.
- 2. Demonstrate the sequence alignment tool inbioinformatics.
- 3. Construct the phylogenetic trees forevolution.
- 4. Analyze the three dimensional protein structure and classification using varioustools.
- 5. Illustrate the protein secondary structure prediction by comparativemodeling.
- 6. Extend the knowledge in micro array technology and applications of bioinformatics in varioussectors.

## UNITI OVERVIEW OFBIOINFORMATICS

The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

## UNITII RETRIEVAL OFBIOLOGICALDATA

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

## UNITIII PHYLOGENETICS

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

## UNITIV STRUCTURALBIOINFORMATICS

Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

## UNITV MICROARRAYDATAANALYSIS

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

**9** ta

9

## 9

9

## 9



#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dan E. Krane, Michael L. Rayme	Fundamental Concepts of Bioinformatics	Pearson education	2004
2	Andreas D., F. Francis Ouellette	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins	Wiley-Interscience	2004
3	David W. Mount	Sequence and Genome Analysis	Cold Spring Harbor Laboratory	2004
4	Jonathan Pevsner	Bioinformatics and Functional Genomics	Wiley-Liss	2003

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Michael J. Korenberg	Microarray Data Analysis: Methods and Applications	Springer Science & Business Media	2007

#### FUNDAMENTALS OF NANO BIOTECHNOLOGY **15BTBTOE07**

## **COURSE OBJECTIVES**

- 1. To impart the skills in the field of nano biotechnology and itsapplications.
- To acquire knowledge in the nano particles and its significance in various fields. 2.
- To extend the knowledge in types and application of nano particles insensors. 3.
- To define the concepts of biomaterials through molecular selfassembly. 4.
- To equip students with clinical applications of nanodevices. 5.
- 6. To describe deeper understanding of the socio-economic issues innanobiotechnology.

## **COURSE OUTCOMES**

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

- 1. Develop skills in the field of nano biotechnology and itsapplications.
- 2. Summarize the nanoparticles and its significance in variousfields.
- 3. Extend the knowledge in types and application of nano particles insensors.
- 4. Define the concepts of biomaterials through molecular selfassembly.
- 5. Outline the clinical applications of nanodevices.
- 6. Describe the socio-economic issues innanobiotechnology.

## UNITIINTRODUCTION

Introduction, Scope and Overview, Length scales, Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

## UNIT IINANOPARTICLES

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes.

#### **APPLICATIONS** UNITIII

Nanomedicine, Nanobiocensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems.Nano-Biodevices and Systems.Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine.

#### UNITIV NANOBIOTECHNOLOGY

Clinical applications of nanodevices. Artificial neurons. Real-time nanosensors- Applications in cancer biology.Nanomedicine.Synthetic retinyl chips based on bacteriorhodopsins.High throughput DNA sequencing with nanocarbon tubules. Nanosurgical devices.

#### UNITV ETHICAL ISSUESINNANOTECHNOLOGY

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

## 9

9

9

9

### 15BTBTOE07FUNDAMENTALS OF NANO BIOTECHNOLOGY3

## TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Niemeyer. C.M. and Mirkin. C.A	Nanobiotechnology: Concepts, Applications and Perspectives	Wiley- VCH	2004
2	Goodsell. D.S.	Bionanotechnology	John Wiley and Sons, Inc	2004

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Shoseyov. O., Levy. I	Nanobiotechnology: Bioinspired Devices and Materials of the Future	Humana Press	2007
2	Bhushan. B.	Springer Handbook of Nanotechnology	Springer- Verlag Berlin Heidelberg	2004
3	FreitasJrR.A	Nanomedicine	Landes Biosciences	2004
4	Kohler. M. and Fritzsche. W.	Nanotechnology – An Introduction to Nanostructuring Techniques	Wiley- VCH	2004

#### **15BEAEOE01**

#### AUTOMOBILEENGINEERING

- 1. To impart the knowledge on constructional details and principle of operation of various automobile components.
- 2. To learn the function and working of various components in transmission and drivelines.
- 3. To study the concept and working of steering and suspension systems in anautomobile.
- 4. To give the knowledge on wheels, tyres and brakes of automobiles.
- 5. To provide the information on current trends
- 6. To provide the information on future trends inautomobiles.

#### COURSE OUTCOMES:

Upon successful completion of the course, the students should be able to:

- 1. Demonstrate the operating principles and constructional details of various automobilecomponents.
- 2. Explain the function and working of components in transmission and drivelines.
- 3. Identify and explain the types of steering system
- 4. Identify and explain the types of suspensionsystem.
- 5. Classify and describe the types of wheels, tyres and brakes of automobiles.
- 6. Discuss the current and future trends in theautomobiles.

## UNITI ENGINE AND FUELFEEDSYSTEMS

Classification of Engine, construction and working of four stroke petrol and diesel engine, firing order and its significance. Carburettor working principle, requirements of an automotive carburettor, Petrol injection Systems (MPFI, TBI), Diesel fuel injection systems (CRDI)

## UNITII TRANSMISSIONSYSTEMS

Requirements of transmission system.Flywheel. Different types of clutches, principle, Construction, torque capacity and design aspects. Objective of the gearbox - Determination of gear ratios for vehicles. Performance characteristics at different speeds. Different types of gearboxes - operation. Function of Propellar Shaft Construction details of multi drive axle vehicles. Different types of final drive. Differential principles. Constructional details of differential unit. Non-slip differential. Differential lock

## UNITIII SUSPENSIONSYSTEM

Need of suspension system - Types of suspension - Suspension springs - Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension - Rubber suspension - Pneumatic suspension - Hydro Elastic suspension - Shock absorbers. Vibration and driving comfort.

## UNITIV BRAKES

Necessity of brake, stopping distance and time, brake efficiency, weight transfer, shoe brake and disc brake theoryBrake actuating systems - Mechanical, Hydraulic and Pneumatic. Parking and engine exhaust brakes. Power and power assisted brakes. Antilock Braking System (ABS).

## UNITV ELECTRICALSYSTEM

Principle and construction of lead acid battery.Lighting system: details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.Starting System and charging system.

## TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication	
-----------	----------------	-------------------	-----------	------------------------	--

3003100

## 9

9

## 9

## 9

1	Young U.P and Griffiths L	Automotive Electrical Equipment	ELBS & New Press	1999
2	Ganesan.V	Internal Combustion Engines	Tata McGraw-Hill Publishing Co., New Delhi	2003
3	Dr.Kirpal Singh	Automobile Engineering	Standard Publishes	2011

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Heldt .P.M	The Automotive Chassis	Literary Licensing,LLC	2012
2	Crouse.W.H	Automobile Electrical Equipment	McGraw-Hill Book Co., Inc., New York.	1986
3	N.Newton, W. Steeds and T.K.Garrett	The Motor vehicle, 13th edition	SAE Inc	2001

## 15BEAEOE02BASICS OF TWO AND THREE WHEELERS

## **COURSE OBJECTIVES**

- 1. The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.
- 2. Construct the frames of two and three wheelers of different layouts.
- 3. Demonstrate the constructional details and principle of operation of various engine components.
- 4. Identify and explain the types of transmission systems.
- 5. Identify and explain the types of steering and suspension systems.
- 6. Classify and describe the types of wheels, tyres and brakes for two and three wheelers

## COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:

- 1. Construct the frames of two and three wheelers of different layouts.
- 2. Demonstrate the constructional details and principle of operation of various engine components.
- 3. Identify and explain the types of transmission systems.
- 4. Identify and explain the types of steering and suspension systems.
- 5. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
- 6. Explain the servicing of two and three wheelers

## UNITI INTRODUCTION

Classifications- design considerations –weight and dimension limitations – requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

# UNITII POWER UNITS, IGNITION SYSTEMS AND OTHERELECTRICALSYSTEMS

2 stoke and 4 stoke SI engines and CI engines design criteria– design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

## UNITIII CLUTCHES ANDTRANSMISSION

Types of clutches for 2 and 3 wheelers. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

## UNITIV FRAMES, SUSPENSION, WHEELS ANDTYRES

Types of frames used for two wheelers and three wheelers. Wheel frames- construction design of frames for fatigue strength torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

## UNITV THREEWHEELERS

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment type types. Brakes and their operating mechanism.

## TOTAL 45PERIODS

#### TEXTBOOKS

#### 134

## 9

9

### 9

## 9

#### **15BEAEOE02 BASICS OF TWO AND THREE WHEELERS** 3003100 S. Year of Author(s) Name Title of the book Publisher No. Publication 1992 1 Irving P.E. Motor Cycle Engineering. Temple Press Book, London. 2 Srinivasan.S. Motor cycle, Scooter, Mobeds. New century book house. 1988

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	M.M.Griffin.	Motor cycles from inside and outside.	Prentice Hall Inc, New Jersey.	1978
2	Bruce A. Johns and Robert Scharff	Motorcycles: Fundamentals, Service, Repair	Goodheart-Willcox	1999

#### **15BEAEOE03**

#### **COURSE OBJECTIVES**

- 1. The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems inAutomobile.
- 2. Describe and differentiate the types of maintenance.
- 3. List the procedure for dismantling, servicing and assembling of engine components.
- 4. Demonstrate the servicing of transmission and driveline components.
- 5. Discuss the procedure for steering and suspension
- 6. Discuss the procedure for wheel and brake maintenance.

### **COURSE OUTCOMES**

Upon successful completion of the course, the students should be able to:

- 1. Describe and differentiate the types of maintenance.
- 2. List the procedure for dismantling, servicing and assembling of engine components.
- 3. Demonstrate the servicing of transmission and driveline components.
- 4. Discuss the procedure for steering and suspension
- 5. Discuss the procedure for wheel and brake maintenance.
- 6. Explain the fault diagnosis in the electrical and air conditioner systems

## UNITI MAINTENANCE OF RECORDSANDSCHEDULES

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance.

## UNITII ENGINEMAINTENANCE

Dismantling of engine components and cleaning, cleaning methods, visual anddimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

## UNITIII CHASSIS MAINTENANCE

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system, Maintenance servicing of suspension systems. Brake systems, types and servicing techniques, Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheelbalancing.

## UNITIV ELECTRICALSYSTEM MAINTENANCE

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems, Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

## UNITV MAINTENANCE OFFUEL SYSTEM, COOLING SYSTEMS, LUBRICATION

## 9 SYSTEM AND VEHICLEBODY

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply, Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives, Lubrication maintenance, lubricating oil changing, greasing of parts, Vehicle

9

9

# 9

body maintenance, minor and major repairs. Door locks and window glass actuating systemmaintenance.

## TOTAL 45PERIODS

#### TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	John Doke	Fleet Management	McGraw Hill Co	1984
2	James D Halderman	Advanced Engine Performance Diagnosis	Prentice Hall Publications	2011

#### REFERENCE

1. Service Manuals from Different VehicleManufacturers

#### **COURSE OBJECTIVES:**

- 1. To impart knowledge on trends in the vehicle power plants.
- 2. To learn the various advanced driver assistance systems.
- 3. To study the working of advanced suspension and braking systems in an automobile.
- 4. To give information about motor vehicle emission and noise pollution control.
- 5. To provide knowledge of the vehicle telematics.
- 6. To give information about the noise control techniques

#### **COURSE OUTCOMES:**

#### Upon successful completion of the course, the students should be able to:

- 1. Distinguish and describe the various modern vehicle power plant systems.
- 2. List and explain the various driver assistant mechanisms.
- 3. Identify and describe the working of advanced suspension and braking systems.
- 4. Apply the knowledge of motor vehicle emission and noise pollution control.
- 5. Describe the noise control techniques
- 6. Describe the vehicle telematics and its applications

#### TRENDS INPOWERPLANTS UNITI

Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles -Electric propulsion with cables - Magnetic track vehicles.

#### UNITII DRIVERASSISTANCESYSTEMS

Collision Avoidance Systems, Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut- off technology, ABS, Driver Drowsiness Detection system

#### UNITIII SUSPENSION BRAKESANDSAFETY

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passengercomfort.

#### UNITIV NOISE&POLLUTION

Reduction of noise - Internal & external pollution control through alternate fuels/power plants -Catalytic converters and filters for particulate emission.

#### UNITV TELEMATICS

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

## TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	LjuboVlacic and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford	2001

9

9

## 9

# 9

<b>15BE</b>	AEOE04	<b>INTRODUCTION TO MODE</b>	RN VEHICLE	3 0 0 3100
2	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems – Progress in Technology	Automotive Electronics Series, SAE, USA.	1998

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	William B Riddens	"Understanding Automotive Electronics"	Butterworth Heinemann Woburn.	1998
2	Bechhold,	"Understanding Automotive Electronics"	SAE	1998
3	Robert Bosch,	"Automotive HandBook"	SAE	2000

### **CIVIL ENGINEERING**

## 15BECEOE01 HOUSING, PLANANDMANAGEMENT

#### **COURSE OBJECTIVES**

- 1. To examine the role and tasks of basic housing policies and building bye laws
- 2. Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
- 3. Analyze the Innovative construction methods and Materials
- 4. Analyze city management strategies and strengthen the urban governance through a problem solving approach
- 5. To know the Importance of basic housing policies and building bye laws
- 6. To use Housing Programmes and Schemes

### **COURSE OUTCOMES**

The students will be able to

- 1. Know the Importance of basic housing policies and building bye laws.
- 2. Use Housing Programmes and Schemes.
- 3. Plan and Design of Housing projects.
- 4. Examine Innovative construction methods and Materials.
- 5. Know Housing finance and loan approval procedures.
- 6. Understand Construction as well as managing techniques.

## UNITI INTRODUCTIONTOHOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

## UNITII HOUSINGPROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

## UNITIII PLANNING AND DESIGN OFHOUSINGPROJECTS

Formulation of Housing Projects - Site Analysis, Layout Design, Design of Housing Units (Design Problems)

# UNITIV CONSTRUCTION TECHNIQUES ANDCOST-EFFECTIVEMATERIALS

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

## UNITV HOUSING FINANCE ANDPROJECTAPPRAISAL

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

## TOTAL 45PERIODS

TEXTBOOKS

3 0 0 3100

## 9

### 9

9

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Meera Mehta and Dinesh Mehta	Metropolitan Housing Markets	Sage Publications Pvt. Ltd., New Delhi	2002
2	Francis Cherunilam and Odeyar D Heggade	Housing in India	Himalaya Publishing House, Bombay	2001

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	СМА	Development Control Rules for Chennai Metropolitan Area	CMA, Chennai	2002
2	UNCHS	National Experiences with Shelter Delivery for the Poorest Groups	UNCHS (Habitat), Nairobi	2000

## **15BECEOE02**

#### **BUILDING SERVICES**

## **COURSE OBJECTIVES**

- 1. Defining and identifying of engineering services systems in buildings.
- 2. The role of engineering services systems in providing comfort and facilitating life of users of the building.
- 3. The basic principles of asset management in a building & facilities maintenance environment
- 4. Importance of Fire safety and its installation techniques
- 5. To Know the principle of Refrigeration and application
- 6. To Understand Electrical system and its selection criteria

## **COURSE OUTCOMES**

The students will be able to

- 1. Machineries involved in building construction
- 2. Understand Electrical system and its selection criteria
- 3. Use the Principles of illumination & design
- 4. Know the principle of Refrigeration and application
- 5. Importance of Fire safety and its installation techniques
- 6. Know the principle behind the installation of building services and to ensure safety in buildings

## UNITI MACHINERIES

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

## UNITII ELECTRICAL SYSTEMSINBUILDINGS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

## UNITIII PRINCIPLES OF ILLUMINATION&DESIGN

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in buildingtypes.

## UNITIV REFRIGERATION PRINCIPLES& APPLICATIONS

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

## UNITV FIRESAFETYINSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non- combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

138

## 9

9

9

9



#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	E.R.Ambrose	Heat Pumps and Electric Heating	John and Wiley and Sons, Inc., New York	2002
2	NBC	Handbook for Building Engineers in Metric systems	NBC, New Delhi	2005

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	-	Philips Lighting in Architectural Design	McGraw-Hill, New York	2000
2	A.F.C. Sherratt	Air-conditioning and Energy Conservation	The Architectural Press, London	2005
3	National Building Code			

#### **15BECEOE03**

#### **COURSE OBJECTIVES**

- 1. To understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.
- 2. To describe the Coastal zone regulations, coastal processes and wave dynamics.
- 3. To forecast waves and tides and plan coastal structures including harbours.
- 4. To explain which scientific background values that are necessary for a successful planning,
- 5. To apply knowledge about ecosystem values and management in the planning process,
- 6. To plan and carry out a simplified consultation process for activities in the coastal zone

#### **COURSE OUTCOMES**

- 1. Understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.
- 2. The Coastal zone regulations, coastal processes and wave dynamics.
- 3. Forecast waves and tides and plan coastal structures including harbours.
- 4. To explain which scientific background values that are necessary for a successful planning.
- 5. To apply knowledge about ecosystem values and management in the planning process,
- 6. To plan and carry out a simplified consultation process for activities in the coastal zone.

#### UNITI COASTALZONE

Coastal zone - Coastal zone regulations - Beach profile - Surf zone - Off shore - Coastal waters -Estuaries-

Wet lands and Lagoons – Living resources – Non living resources.

#### WAVEDYNAMICS UNITII

Wave classification - Airy's Linear Wave theory - Deep water waves - Shallow water waves -Wavepressure

- Wave energy - Wave Decay - Reflection, Refraction and Diffraction of waves - Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles.

#### UNITIII WAVE FORECASTINGANDTIDES

Need for forecasting - SMB and PNJ methods of wave forecasting - Classification of tides -Darwin's

equilibrium theory of tides – Effects on structures – seiches, Surges and Tsunamis.

#### UNITIV COASTALPROCESSES

Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers - Sea water intrusion - Impact of sewage disposal in seas.

#### UNITV HARBOURS

Types of classification of harbours – Requirements of a modern port – Selection of site – Types and selection of break waters – Need and mode of dredging – Selection ofdredgers.

## TOTAL 45PERIODS

#### **TEXTBOOKS**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Richard Sylvester	Coastal Engineering, Volume I and II	Elseiner Scientific Publishing Co	2006

9

#### 9

9

9

2	Quinn, A.D	Design & Construction of Ports and Marine Structures	McGraw-Hill Book Co	2007
---	------------	---	---------------------	------

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ed. A.T. Ippen	Coastline Hydrodynamics	McGraw-Hill Inc., New York	2002
2	Dwivedi, S.N., and Ramachandran, S	Coastal Zone Management in Tamilnadu	McGraw-Hill Inc., New York	2000

## **COURSE OBJECTIVES**

- 1. To Describe some of the factors affecting reproducibility and external validity.
- 2. To List the different types of formal experimental designs (e.g. completely randomised, randomised block, repeated measures, Latin square and factorial experimental designs).
- 3. To explain the concept of variability, its causes and methods of reducing it
- 4. To describe possible causes of bias and ways of alleviating it
- 5. To identify the experimental unit and recognise issues of non-independence (pseudo-replication).
- 6. To describe the six factors affecting significance, including the meaning of statistical power and "p-values".

## **COURSE OUTCOMES**

- 1. Describe some of the factors affecting reproducibility and external validity.
- 2. List the different types of formal experimental designs (e.g. completely randomised, randomised block, repeated measures, Latin square and factorial experimental designs).
- 3. Explain the concept of variability, its causes and methods of reducing it
- 4. Describe possible causes of bias and ways of alleviating it
- 5. Identify the experimental unit and recognise issues of non-independence (pseudo-replication).
- 6. Describe the six factors affecting significance, including the meaning of statistical power and "p-values".

## UNITI MEASUREMENTS

Basic Concept in Measurements, Measurement of displacement, strain pressure, force, torque etc, Type of strain gauges (Mechanical, Electrical resistance, Acoustical etc)

## UNITII GAUGING

Strain gauge circuits – The potentiometer and Wheatstone bridge – use of lead wires switches etc. Use of electrical resistance strain gauges in transducer applications.

## UNITIII RECORDINGDEVICES

Indicating and recording devices - Static and dynamic data recording –Data (Digital and Analogue) acquisition and processing systems. Strain analysis methods – Rosette analysis. Static and dynamic testing techniques. Equipment for loading - Moire's techniques.

## UNITIV NON DESTRUCTIVETESTINGTECHNIQUES

Non destructive testing techniques. Photoelasticity – optics of photoelasticity – Polariscope – Isoclinics and Isochromatics - methods of stress separation.

## UNITV LAWS OFSIMILITUDE

Laws of similitude - model materials - model testing - testing large scale structures - holographic techniques

## TOTAL 45PERIODS

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dally J W and Riley W.F	Experimental stress Analysis	McGraw-Hill, Inc. New York	2005

#### 3003100

## 9

9

9

9

15BECEOE04 EXF		EXPER	RIMENTAL METHOD AND MODEL ANALYSIS		3003100
2	Srinath L S		Experimental Stress Analysis	Tata McGraw-Hill Publishing co., Ltd., New Delhi	2006

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rangan C S	Instrumentation – Devices and Systems	Tata McGraw-Hill Publishing Co., Ltd., New Delhi	2002
2	Sadhu Singh	Experimental Stress Analysis	Khanna Publishers, New Delhi	2006

#### 15BECEOE05 MANAGEMENT OF IRRIGATION SYSTEMS

#### **COURSE OBJECTIVES**

- 1. To enable the students for a successful career as water management professionals.
- 2. To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
- 3. To expose the students the need for an interdisciplinary approach in irrigation water management
- 4. To providing a platform to work in an interdisciplinary team.
- 5. To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.
- 6. To promote student awareness for a life-long learning process and inculcate professional ethics and codes of professional practice in water management.

#### **COURSE OUTCOMES**

At the end of this the students will be in a capacity to

- 1. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
- 2. Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
- 3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.
- 4. Gain insight on local and global perceptions and approaches to participatory water resource management
- 5. Learn from successes and failures in the context of both rural and urban communities of water management.
- 6. Exposure on the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.

## UNITI IRRIGATIONSYSTEMREQUIREMENTS

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

## UNITII IRRIGATIONSCHEDULING

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

## UNITIII MANAGEMENT

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

## UNITIV OPERATION

Operational plans – Main canals, laterals and field channels – Water control and regulating structures –

Performance indicators – Case study

## UNITV INVOLVEMENT OFSTAKEHOLDERS

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

## TOTAL 45PERIODS

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dilip Kumar Majumdar	Irrigation Water Management – Principles and Practice	Prentice Hall of India Pvt. Ltd., New Delhi	2000

### 9

# **9**

9

9

15BECEOE05		CEOE05 M	1ANAGEMENT OF IRRIGATION SYSTEMS		3 0 0 3100
	2	DT Candhi	Hand book on Irrigation Water	Water Management Division,	1000
	2	K. I. Galiulli	Requirement	Department of Agriculture	1990

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Technical report No. 33,	Hand Book on Irrigation System Operation Practices	CWC, New Delhi	2000
2	Maloney, C. and Raju, K.V	Managing Irrigation Together - Practice and Policy in India	, Stage Publication, New Delhi, India	2000
### 15BECEOE06 COMPUTER AIDED DESIGN OF STRUCTURES

### **COURSE OBJECTIVES**

- 1. To learn how to Develop Parametric design and the conventions of formalengineering drawing
- 2. To learn how to Produce and interpret 2D &3Ddrawings
- 3. To learn about how to Communicate a design idea/conceptgraphically/visually
- 4. To know how to Examine a design critically and with understanding of CAD The student learns to interpret drawings, and to produce designs using a combination of 2D and 3Dsoftware.
- 5. To discuss how to Get a Detailed study of anengineering artifact
- **6.** To know how to Plan and designstructures

#### **COURSE OUTCOMES**

The students will be able to

- 1. Develop Parametric design and the conventions of formalengineering drawing
- 2. Produce and interpret 2D &3Ddrawings
- 3. Communicate a design idea/conceptgraphically/visually
- 4. Examine a design critically and with understanding of CAD The student learns to interpret drawings, and to produce designs using a combination of 2D and 3Dsoftware.
- 5. Get a Detailed study of anengineering artifact
- 6. Plan and designstructures

### UNITI INTRODUCTION

Fundamentals of CAD - Hardware and software requirements -Design process - Applications and benefits.

### UNITII COMPUTERGRAPHICS

Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards – Drafting packages

### UNITIII STRUCTURALANALYSIS

Fundamentals of finite element analysis - Principles of structural analysis - Analysis packages and applications.

### UNITIV DESIGNANDOPTIMISATION

Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming – Simplex method

### UNITV EXPERTSYSTEMS

Introduction to artificial intelligence - Knowledge based expert systems -Rules and decision tables – Inference mechanisms - Simple applications.

### TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Groover M.P. and Zimmers E.W. Jr	CAD/CAM, Computer Aided Design and Manufacturing	Prentice Hall of India Ltd, New Delhi	2005
2	Krishnamoorthy C.S.Rajeev S	Computer Aided Design	Narosa Publishing House, New Delhi	2000

#### TEXTBOOKS

#### 142

### ne 9

9

# 9

### 9

#### 15BECEOE06 COMPUTER AIDED DESIGN OF STRUCTURES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Harrison H.B	Structural Analysis and Design	Part I and II Pergamon Press, Oxford	2002
2	Rao S.S	Optimisation Theory and Applications	Wiley Eastern Limited, New Delhi	2002
3	Richard Forsyth (Ed)	Expert System Principles and Case Studies	Chapman and Hall, London	2000

#### COURSE OBJECTIVES

- 1. To discuss about the various pavement types
- 2. To study about the stress distribution in layered systems
- 3. To design the flexible pavements
- 4. To learn about the concepts of rigid pavements
- 5. To learn about the performance evaluation and maintenance of pavements
- 6. To know how to stabilization of pavements

#### **COURSE OUTCOMES**

Students will be able to

- 1. Recognize the various pavement types
- 2. Understand the stress distribution in layered pavements
- 3. Design a flexible pavement
- 4. Explain about the rigid pavements
- 5. Perform pavement performance evaluation and maintenance
- 6. Know how to stabilize the pavements

### UNITI TYPE OF PAVEMENT AND STRESS DISTRIBUTION ONLAYEREDSYSTEM

9

9

9

9

9

Introduction - Pavement as layered structure - Pavement types - rigid and flexible -Stress and deflections in pavements under repeated loading

### UNITII DESIGN OFFLEXIBLEPAVEMENTS

Flexible pavement design - Empirical - Semi empirical and theoretical Methods - Design procedure as per latest IRC guidelines – Design and specification of ruralroads

### UNITIII DESIGN OFRIGIDPAVEMENTS

Cement concrete pavements - Modified Westergard approach - Design procedure as per latest IRC guidelines - Concrete roads and their scope in India.

### UNITIV PERFORMANCE EVALUATIONANDMAINTENANCE

Pavement Evaluation [Condition and evaluation surveys (Surface Appearance, Cracks, Patches And Pot Holes, Undulations, Ravelling, Roughness, Skid Resistance), Structural Evaluation By Deflection Measurements, Present Serviceability Index] Pavement maintenance. [IRC Recommendations Only]

### UNITV STABILISATIONOFPAVEMENTS

Stabilisationwithspecialreferencetohighwaypavements-Choiceofstabilisers-Testingandfieldcontrol–Stabilisation for rural roads in India -use of Geosynthetics (geotextiles & geogrids) in roads.

### TOTAL 45PERIODS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kadiyali, L.R	Principles and Practice of Highway Engineering	Khanna tech. Publications, New Delhi	2007
2	Croney, D	Design and Performance of Road Pavements	HMO Stationary Office	2005
3	Wright, P.H	Highway Engineers	John Wiley & Sons, Inc., New York	2001

#### TEXTBOOKS

					-
4	Ministry of rural roads	Design and Specification of Rural Roads (Manual)	Government of India, New Delhi	2001	

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Yoder R.J and WitczakM.W	Principles of Pavement Design	John Wiley	2003
2	IRC:37	Guidelines for the Design of Flexible Pavements	The Indian roads Congress, New Delhi	2001
3	IRC:58	Guideline for the Design of Rigid Pavements for Highways	The Indian Roads Congress, New Delhi	2001

#### COURSE OBJECTIVES

- 1. To provide the knowledge on classification of rocks
- 2. To learn about the properties of rocks
- 3. To learn about the rock failure modes
- 4. To learn about the initial stresses and measurements
- 5. To know the applications of rock mechanics
- 6. To understand the concepts of rock bolting

### COURSE OUTCOMES

#### Students will be able

- 1. Recognize the various forms of rocks
- 2. Say the various properties of rocks
- 3. Explain the failure modes of the rocks
- 4. Understand the initial stresses and how to measure the same
- 5. Say the various applications of rock mechanics
- 6. Explain the concepts of rock bolting

## UNITI CLASSIFICATION AND INDEX PROPERTIESOFROCKS 9

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.

### UNITII ROCK STRENGTH ANDFAILURECRITERIA

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength – Stress strain behaviour in compression – Mohr-coulomb failure criteria and empirical criteria for failure – Deformability of rock.

### UNITIII INITIAL STRESSES ANDTHEIRMEASUREMENTS

Estimationofinitialstressesinrocks-influenceofjointsandtheirorientationindistributionofstresses-technique for measurements of insitu stresses.

### UNITIV APPLICATION OF ROCK MECHANICSINENGINEERING

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

### UNITV ROCKBOLTING

Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.

### TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Goodman P.E	Introduction to Rock Mechanics	John Wiley and Sons	2005
2	Stillborg B	Professional User Handbook for rock Bolting	Tran Tech Publications	2006

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Brow E.T	Rock Characterisation Testing and Monitoring	Pergaman Press	2002

9

9

9

#### **15BECEOE08**

#### **ROCK ENGINEERING**

2	Arogyaswamy R.N.P	Geotechnical Application in Civil Engineering	Oxford and IBH	2000
3	Hock E. and Bray J	Rock Slope Engineering	Institute of Mining and Metallurgy	1991

#### **COURSE OBJECTIVES:**

- 1. To build on the student's background in hydrology and hydraulics and understanding of waterresources systems
- 2. To develop the skills in modeling of flood flows and flood routing
- 3. To develop skills in the ground water flow, type of aquifer and yield from the well
- 4. To provide the knowledge of design of reservoir, operation and sedimentation
- 5. To study the effect, causes and remedial measures of water logging
- 6. To know about various concrete bunkers and silos

#### **COURSE OUTCOMES:**

Students will be able to

- 1. Understand about the steel water tanks
- 2. Understand about the concrete water tanks
- 3. Explain about the steel bunkers
- 4. Say the working of silos
- 5. Give basics of concrete bunkers
- 6. Understand the basics of prestresses concrete water tanks

### UNITI STEELWATERTANKS

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays –Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder – Design of staging andfoundation.

### UNITII CONCRETEWATERTANKS

Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of under ground tanks – Design of base slab and side wall – Check for uplift.

### UNITIII STEEL BUNKERSANDSILOS

Designofsquarebunker–Jansen'sandAiry'stheories–ISCodalprovisions–Designofsideplates– Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.

### UNITIV CONCRETE BUNKERSANDSILOS

Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction.

### UNITV PRESTRESSED CONCRETEWATERTANKS

Principles of circular prestressing – Design of prestressed concrete circular water tanks.

### TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rajagopalan K	Storage Structures	Tata McGraw-Hill, New Delhi	2002
2	Krishna Raju N	Advanced Reinforced Concrete Design	CBS Publishers and Distributors, New Delhi	2000

REFERENCES

### 9

9

### 9

9

### **15BECEOE09**

#### **STORAGE STRUCTURES**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	R.G.Hopkinson and J.D.Kay	The Lighting of buildings	Faber and Faber, London	2000
2	William H.Severns and Julian R.Fellows	Air-conditioning and Refrigeration	John Wiley and Sons, London	2000

9

9

9

9

9

#### **COURSE OBJECTIVE**

- 1. To provide knowledge on wind data
- 2. To explain about the various factors involved in wind engineering
- 3. To study about the effect on wind on various structures
- 4. To learn about the effect of typical buildings
- 5. To learn about the design of multistory buildings
- 6. To know about the basics of wind tunnel

#### COURSE OUTCOMES

Students will be

- 1. Able to know about the wind data
- 2. Able to explain the factirs involved in wind engineering
- 3. Able to recognize the effects of wind of varuosu structures
- 4. Able to provide the details on typical buildings
- 5. Able to give the basics of desing of multistorey buildings
- 6. Able to explain the basics of wind tunnel

### UNITI INTRODUCTION

Terminology – Wind Data – Gust factor and its determination - Wind speed variation with height – Shape factor – Aspect ratio – Drag and lift.

### UNITII EFFECT OF WINDONSTRUCTURES

Static effect – Dynamic effect – Interference effects (concept only) – Rigid structure – Aeroelastic structure (concept only).

### UNITIII EFFECT ONTYPICALSTRUCTURES

Tail buildings - Low rise buildings - Roof and cladding - Chimneys, towers and bridges.

### UNITIV APPLICATIONTODESIGN

Design forces on multistorey building, towers and roof trusses.

### UNITV INTRODUCTION TOWINDTUNNEL

Types of models (Principles only) - Basic considerations - Examples of tests and their use.

### TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Peter Sachs	Wind Forces in Engineering	Pergamon Press, New York	2002
2	Lawson T.V	Wind Effects on Buildings, Vol. I & II	Applied Science and Publishers, London	2005

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	DevenportA.G	Wind Loads on Structures	Division of Building Research, Ottowa	2003
2	Course Notes	Wind Force on Structures	Building Technology Centre, Anna University	2002

### 15BECEOE11 ADVANCED CONSTRUCTION TECHNOLOGY

#### **COURSE OBJECTIVES**

- 1. To give an experience in the implementation of new technology concepts which are applied in field of Advanced construction.
- 2. To study different methods of construction to successfully achieve the structural design with recommended specifications.
- 3. To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
- 4. To study of construction equipment's, and temporary works required to facilitate the construction process
- 5. To provide a coherent development to the students for the courses in sector of Advanced construction technology.

#### **6.** To present the new technology of civil Engineering and concepts related Advanced construction technology.

COURSE OUTCOMES:

- 1. The students will gain an experience in the implementation of new construction technology on engineering concepts
- 2. the students will learn about how to apply in field of Advanced construction technology.
- 3. The students will get a diverse knowledge of Advanced technology practices applied to real life problems.
- 4. The students will learn to understand the theoretical and practical aspects of new technology in civil engineering
- 5. The students will learn to design and
- 6. The students will learn about management applications

#### UNITI MODERNCONSTRUCTIONMETHODS

Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

#### UNITII CONSTRUCTION METHODS FORSPECIALSTRUCTURES

Construction Methods For Bridges, Construction Methods for Roads, Construction Methods For Special Structures for Railways, Construction Methods for Dams, Construction Methods for Harbour, Construction Methods for River Works Pipelines

#### UNITIII MODERN CONSTRUCTION EQUIPEMENTS-I

Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting, Tunneling and hoisting

#### UNITIV MODERN CONSTRUCTION EQUIPEMENTS-II

Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

#### UNITV PRINCIPLES AND PRACTICES OFTEMPORARYSTRUCTURES

Principles and Practices of Temporary structures, Shoring, and Strutting, Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Peurifoyu , R. L, Ledbette, W.B	Construction Planning , Equipment and Methods	Mc Graw Hill Co	2000
2	Antill J.M., PWD	Civil Engineering Construction	Mc Graw Hill Book Co	2005

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Varma, M	Construction Equipment and its Planning & Applications	Metropoltian Book Co	2000
2	Nunnaly, S.W	Construction Methods and Management	Prentice – Hall	2000

9

9

9

9

15BECEOE11 A		<b>DVANCED CONSTRUCTION TECHNOLOGY</b>		3 0 0 3100
3	Ataev, S.S	Construction Technology	MIR , Pub	2000

### **OPEN ELECTIVES** (COURSES OFFERED TO OTHER DEPARTMENTS)

#### **15BEMEOE01**

#### **INTRODUCTIONTOMEMS**

#### **COURSE OBJECTIVES**

- 1. To know the characteristics of micro elecromechanical system.
- 2. To understand the working of electrostatic sensors.
- 3. To understand the working of actuators.
- 4. To learn the principle of micromachining.
- 5. To understand the concept of polymer MEMS.
- 6. To understand the concept of optical MEMS.

#### **COURSE OUTCOMES**

- 1. Understand the characteristics of micro elecromechanical system.
- 2. Understand the working of electrostatic sensors.
- 3. Understand the working of actuators.
- 4. Learn the principle of micromachining.
- 5. Understand the concept of polymer MEMS.
- 6. Understand the concept of optical MEMS.

### UNITIINTRODUCTION

Intrinsic Characteristics of MEMS - Energy Domains and Transducers- Sensors and Actuators -Introduction to Micro fabrication - Silicon based MEMS processes - New Materials - Review of Electrical and Mechanical concepts in MEMS - Semiconductor devices - Stress and strain analysis -Flexural beam bending- Torsional deflection.

### UNIT II SENSORSANDACTUATORS-I

Electrostatic sensors - Parallel plate capacitors - Applications - Interdigitated Finger capacitor -Comb drive devices - Micro Grippers - Micro Motors - Thermal Sensing and Actuation - Thermal expansion - Thermal couples - Thermal resistors - Thermal Bimorph - Applications - Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

### UNIT III SENSORSANDACTUATORS-II

Piezoresistive sensors - Piezoresistive sensor materials - Stress analysis of mechanical elements -Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects - piezoelectric materials - Applications to Inertia, Acoustic, Tactile and Flow sensors.

### UNITIVMICROMACHINING

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) - Isotropic Wet Etching - Gas Phase Etchants - Case studies -Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

### UNIT V POLYMER ANDOPTICALMEMS

Polymers in MEMS-Polimide - SU-8 - Liquid Crystal Polymer (LCP) - PDMS - PMMA - Parylene - Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS -Lenses and Mirrors – Actuators for Active Optical MEMS.

#### TOTAL 45PERIODS

#### **TEXT BOOKS**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

#### 3003100

## 9

### 9

9

### 9

1	Chang Liu	Foundations of MEMS	Pearson Education Inc	2006
2	Stephen D Senturia	Microsystem Design	Springer Publication	2000
3	Tai Ran Hsu	MEMS & Micro systems Design and Manufacture	Tata McGraw Hill, New Delhi	2002

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nadim Maluf	An Introduction to Micro Electro Mechanical System Design	Artech House	2000
2	Mohamed Gad-el-Hak	The MEMS Handbook	CRC press Baco Raton	2000
3	Julian w. Gardner, Vijay K. Varadan	Micro Sensors MEMS andSmart Devices	John Wiley & Son LTD	2002
4	James J.Allen	Micro Electro Mechanical System Design	CRC Press Publisher	2010
5	Thomas M.Adams and Richard A.Layton	Introduction MEMS, Fabrication and Application	Springer	2012

ROBOTICS

9

9

9

9

9

#### **COURSE OBJECTIVES**

- 1. To develop the student's knowledge in various robot structures and their workspace.
- 2. To develop student's skills in performing spatial transformations associated with rigid body motions.
- 3. To develop student's skills in perform kinematics analysis of robot systems.
- 4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
- 5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
- 6. To provide the student with some knowledge and skills associated with robot control.

#### **COURSE OUTCOMES**

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

- 1. Understand the fundamentals of therobots
- 2. Describe the robot celldesign
- 3. Know the safety considerations in roboticapplications.

4. The student with knowledge of the singularity issues associated with the operation of robotic systems.

- 5. The student with some knowledge and analysis skills associated with trajectory planning.
- 6. The student with some knowledge and skills associated with robot control.

### UNITI FUNDAMENTALS OFROBOT

Robot – Definition, Need for Robots, Robot Anatomy, Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions, grippers types. Forward kinematics, inverse kinematics-Manipulators with two, three degrees of freedom in 2D - Derivations and problems.

### UNITII DRIVES ANDSENSORS

Drives- hydraulic, pneumatic and electrical. Force sensing, touch and tactile sensors, proximity sensors, non contact sensors and Machine vision sensors. Safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism.

### UNITIII PROGRAMMINGANDAPPLICATIONS

Robot programming languages – VAL programming – Motion Commands, Sensorscommands. Role of robots in inspection, assembly, material handling, underwater, space, nuclear, defence and medical fields.

### UNITIV MACHINEVISION

Machine Vision - Sensing - Low and higher level vision - Image acquisition and digitization - Cameras, CCD,CID, CPD, etc., - Illumination and types - Image processing and analysis - Feature extraction - Applications.

### UNITV IMPLEMENTATION ANDROBOTECONOMICS

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

## TOTAL 45PERIODS

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Klafter R.D., and Negin M	Robotic Engineering - An Integrated Approach	Prentice Hall	2003
2	Groover M.P	Industrial Robotics -Technology Programming and Applications	McGraw Hill	2001

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Craig J.J	Introduction to Robotics Mechanics and Control	Pearson Education	2008
2	Deb S.R	Robotics Technology and Flexible Automation	Tata McGraw Hill Book Co	1994
3	Koren Y	Robotics for Engineers	Mc Graw Hill Book Co	1992
4	Fu.K.S.,Gonzalz R.C. and Lee C.S.G	Robotics Control, Sensing, Vision and Intelligence	McGraw Hill Book Co	1987
5	JanakiramanP.A	Robotics and Image Processing	Tata McGraw Hill	1995
6	Rajput R.K	Robotics and Industrial Automation	S.Chand and Company	2008
7	Surender Kumar	Industrial Robots and Computer Integrated Manufacturing	Oxford and IBH Publishing Co. Pvt. Ltd	1991

#### 15BEMEOE03 INDUSTRIAL SAFETY AND ENVIRONMENT

#### **COURSE OBJECTIVES**

- 1. To recognize and evaluate occupational safety and health hazards in the workplace.
- 2. To determine appropriate hazard controls following the hierarchy of controls.
- 3. To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
- 4. To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- 5. To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
- 6. To prevent or mitigate harm or damage to people, property, or the environment.

#### **COURSE OUTCOMES**

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

- 1. Recognize and evaluate occupational safety and health hazards in the workplace.
- 2. Determine appropriate hazard controls following the hierarchy of controls.
- 3. Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
- 4. Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- 5. Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
- 6. Prevent or mitigate harm or damage to people, property, or the environment.

### UNITI INTRODUCTIONTOLOGISTICS

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain - a new corporate model.

### UNITII PHASES OFSUPPLYCHAIN

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

### UNITIII EVOLUTION OF SUPPLYCHAINMODELS

Strategy and structure - Factors of supply chain - Manufacturing strategy stages - Supply chain progress - Model for competing through supply chain management - PLC grid, supply chain redesign - Linking supply chain with customer.

### UNITIV SUPPLYCHAINACTIVITIES

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

### UNITV SCM ORGANISATION ANDINFORMATIONSYSTEM

The management task - Logistics organization - The logistics information systems - Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. - Case study, ERPSoftware's

### TOTAL 45PERIODS

#### TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Shari.P.B and Lassen.T.S	Managing the global supply chain	Viva books, New Delhi	2000
2	Ayers.J.B	Hand book of supply chain management	The St. Lencie press	2000

#### REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
-----------	----------------	-------------------	-----------	------------------------

### 9

9

9

9

-	15BEMEOE03		INDUSTRIAL SAFETY AND ENVIRONMENT 3		3 0 0 3100	
	1	Nicolas.J.N	Competitive manufacturing management - continuous improvement, Lean production, customer focused quality	McGrawHill, New York	1998	
	2	Steudel.H.J and Desruelle.P	Manufacturing in the nineteen - How to become a mean, lean and world class competitor	Van No strand Reinhold, New York	1992	

#### **15BEMEOE04**

#### **COURSE OBJECTIVES**

- 1. To generalized equations for mass, momentum and heat.
- 2. To understand the concepts of Reynolds and Gauss theorems.
- 3. To learn combined diffusive and convective transport.
- 4. To apply Film- and penetration models for mass and heat transfer.
- 5. To apply Stefan-Maxwells equations for multi-component diffusion.
- 6. To Solve the given set of equations either analytically or numerically.

#### COURSE OUTCOMES

- 1. Generalized equations for mass, momentum and heat.
- 2. Understand the concepts of Reynolds and Gauss theorems.
- 3. Learn combined diffusive and convective transport.
- 4. Apply Film- and penetration models for mass and heat transfer.
- 5. Apply Stefan-Maxwells equations for multi-component diffusion.
- 6. Solve the given set of equations either analytically or numerically.

### UNITI INTRODUCTION ANDBASICCONCEPTS

General overview of transport phenomena including various applications, Transport of momentum, heat and mass, Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

### UNITII PROPERTIES, UNITS AND OTHERPHYSICALPARAMETERS 9

Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

### UNITIII MOMENTUM TRANSPORT

Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non- Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

### UNITIV ENERGYTRANSPORT

Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heattransfer

### UNITV MASS TRANSPORT

Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion- Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

### TOTAL 45PERIODS

REFERENCE

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Geankoplis, C. J	Transport Processes and Separation Processes Principles	Prentice Hall	2003

#### WEB REFERENCE

### 9

9

9

### INTRODUCTION TO BIOMECHANICS

### 15BEMEOE05 COURSE OBJECTIVES

- 1. To describe the principles of the study of human movement.
- 2. To describe the range of factors that influence the initiation, production and control of human movement.
- 3. To identify the body's lever systems and their relationship to basic joint movement and classification.
- 4. To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
- 5. To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
- 6. To relate the different body systems necessary for human movement to occur.

### COURSE OUTCOMES

- 1. Describe the principles of the study of human movement.
- 2. Describe the range of factors that influence the initiation, production and control of human movement.
- 3. Identify the body's lever systems and their relationship to basic joint movement and classification.
- 4. Distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
- 5. Explain joint and muscle function and the forces acting upon the human body during various sporting activities.
- 6. Relate the different body systems necessary for human movement to occur.

## UNITI INTRODUCTION

Biomechanics - Improving Performance – Applications - Preventing And Treating Injury -Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

## UNITII KEYMECHANICALCONCEPTS

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

## UNITIII HUMAN ANATOMY AND SOMEBASICTERMINOLOGY

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements

- Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

### UNITIV ANATOMICALDESCRIPTION

Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

## UNITV MECHANICS OF THEMUSCULOSKELETALSYSTEM

Tissue Loads - Response of Tissues To Forces - Biomechanics of The Passive Muscle–Tendon Unit - Biomechanics of Bone - Biomechanics of Ligaments - Three Mechanical Characteristics of Muscle - Stretch- Shortening Cycle (SSC) - Force–Time Principle - Neuromuscular Control

TOTAL 45PERIODS

#### REFERENCE

#### 152

#### 9

# **9**

9

#### **9** d

#### **15BEMEOE05**

### INTRODUCTION TO BIOMECHANICS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Duane Knudson	Fundamentals of Biomechanics	Springer Science+ Business Media, LLC	2007
2	C. Ross Ethier Craig A. Simmons	Introductory Biomechanics	Cambridge University Press	2007