B.E. MECHANICAL ENGINEERING

CURRICULUM AND SYLLABI
(2017 AND ONWARDS)

(REGULAR PROGRAMME)

Department of Mechanical 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. MECHANICAL ENGINEERING (REGULAR)
COURSE OF STUDY AND SCHEME OF EXAMINATIONS

(2017 and onwards)B. E. MECHANICAL
ENGINEERING (REGULAR) COURSE OF STUDY AND
SCHEME OF EXAMINATIONS

(2017 and onwards)

SEMESTER I											
Course Code	**Course title**	**Objectives & Outcomes**		**Instruction Hours / Week**			**Credits**	**Maximum Marks**			
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**	
								40	**60**	**100**	
17BECC101	English for Engineers	1	1,2,3	3	0	0	3	40	60	100	
17BECC102	Engineering Mathematics I	1	1,2,8,9	3	2	0	4	40	60	100	
17BEPH103 / 17BECH103	Engineering Physics / Engineering Chemistry	1, 3	1,2,3,5,8,9	3	0	0	3	40	60	100	
17BEME104	Basic Mechanical Engineering	1, 2	1,2,3,8,9,12	3	0	0	3	40	60	100	
17BEME105A / 17BEME105B	Basic Electrical and Electronics Engineering / Elements of Civil Engineering	1, 3	1,2,3,8,9,11	3	0	0	3	40	60	100	
17BEPH111 / 17BECH111	Engineering Physics Laboratory / Engineering Chemistry Laboratory	1	1,2,5, 10	0	0	4	2	40	60	100	
17BEME112	Engineering Workshop Practice	1, 2	1,2,3,5	0	0	4	2	40	60	100	
17BEME113	Engineering Graphics – I	1, 2	1,2,3,5,9	0	0	4	2	40	60	100	
				Total 15	2	12	22	320	480	800	
VALUE ADDED COURSE											
17BECC151	Yoga	-	--	1	0	0	-	100	0	100	

SEMESTER II											
Course Code	**Course title**	**Objectives & Outcomes**		**Instruction Hours / Week**			**Credits**	**Maximum Marks**			
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**	
								40	**60**	**100**	
17BECC201A / 17BECC201B	Business Communication / Technical English	2	4,5, 10	3	0	0	3	40	60	100	
17BECC202	Engineering Mathematics II	1	1,2,8,9	3	2	0	4	40	60	100	
17BEPH203 / 17BECH203	Engineering Physics / Engineering Chemistry	1, 3	1,2,3,5,8,9	3	0	0	3	40	60	100	
17BECC204	Environmental Sciences	1	1,2,3,4,10	3	0	0	3	40	60	100	
17BEME205A / 17BEME205B	Basic Electrical and Electronics Engineering / Elements of Civil Engineering	1, 3	1,2,3,8,9,11	3	0	0	3	40	60	100	
17BEPH211 / 17BECH211	Engineering Physics Laboratory / Engineering Chemistry Laboratory	1	1,2,5, 10	0	0	4	2	40	60	100	
17BEME212	Computer Practice and Programming Laboratory	1	1,2,9	1	0	4	3	40	60	100	
17BEME213	Engineering Graphics – II	1, 2	1,2,3,5,9	0	0	3	2	40	60	100	
Total				16	2	11	23	320	480	800	
VALUE ADDED COURSE											
17BEME251	Business Plan	-	--	1	0	0	-	100	0	100	

SEMESTER III												
Course Code	**Course title**	**Objectives & Outcomes**		**Instruction Hours / Week**			**Credits**	**Maximum Marks**				
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**		
								40	**60**	**100**		
17BEME301	Methods of Applied Mathematics	1	1,3,5,6,7,8	3	2	0	4	40	60	100		
17BEME302	Engineering Mechanics	1	1,2,3,4,10,11	3	2	0	4	40	60	100		
17BEME303	Manufacturing Technology – I	1	1,2,3,4,10	3	0	0	3	40	60	100		
17BEME304	Fluid Mechanics and Machinery	1	1,2,3,4,10	3	2	0	4	40	60	100		
17BEME305A 17BEME305B	Electrical Drives and Controls/ Electronics andMicroprocessor	1,2	1,2,3,4,6,9,10	3	0	0	3	40	60	100		
17BEME311	Fluid Mechanics and Machinery Laboratory	1	1,2,3,4,5,6,9	0	0	3	2	40	60	100		
17BEME312	Machine Drawing	1	1,2,3,4,10	0	0	3	2	40	60	100		
17BEME313	Electrical Drives and Microprocessor Laboratory	1,2	1,2,3,4,6,9,12	0	0	3	2	40	60	100		
17BEME314	Course Oriented Project I	-	--	0	0	2	1	100	-	100		
Total				**15**	**6**	**11**	**25**	**420**	**480**	**900**		
VALUE ADDED COURSE												
17BEME351	Aptitude Training	-	--	1	0	0	-	100	0	100		

SEMESTERIV												
Course Code	**Course title**	**Objectives & Outcomes**		**Instruction Hours / Week**			**Credits**	**Maximum Marks**				
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**		
								40	**60**	**100**		
17BEME401	Strength of Materials	1	1,2,3,4,10	3	1	0	4	40	60	100		
17BEME402	Manufacturing Technology – II	1	1,2,3,6,8,9	3	0	0	3	40	60	100		
17BEME403	Engineering Thermodynamics	1	1,2,3,4,10	3	1	0	4	40	60	100		
17BEME404A 17BEME404B	Industrial Metallurgy / Engineering Materials	1	1,2,3,4,10	3	0	0	3	40	60	100		
17BEME405	Kinematics of Machinery	1	1,2,3,4,10	3	0	0	3	40	60	100		
17BEME406A 17BEME406B	Engineering Metrology / Industrial Metrology	1	1,2,3,6,8,9	3	0	0	3	40	60	100		
17BEME411	Strength of Materials and Metallurgy Laboratory	1	1,2,3,5,9,10	0	0	3	2	40	60	100		
17BEME412	Manufacturing Technology Laboratory	1	1,2,3,6,8,9,12,14	0	0	4	2	40	60	100		
17BEME413	Course Oriented Project II	-	--	0	0	2	1	100	-	100		
Total				**18**	**5**	**8**	**25**	**420**	**480**	**900**		
VALUE ADDED COURSE												
17BEME451	Production Drawing and Cost Estimation	-	--	1	0	0	-	100	0	100		

SEMESTER V											
Course Code	**Course title**	**Objectives & Outcomes**		**Instruction Hours / Week**			**Credits**	**Maximum Marks**			
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**	
								40	**60**	**100**	
17BEME501	Heat Power Engineering	1	1,2,3,4,10	3	1	0	3	40	60	100	
17BEME502	Design of Machine Elements	1	1,2,3,4,9	3	2	0	4	40	60	100	
17BEME503	Dynamics of Machinery	1	1,2,3,4,9,12	3	2	0	4	40	60	100	
17BEME5E– –	Professional Elective I	--	--	3	0	0	3	40	60	100	
17BEME5E– –	Professional Elective II	--	--	3	0	0	3	40	60	100	
17BEME511	Scientific Computing Laboratory	1	1,3,5,6,7,8,10	2	0	2	3	40	60	100	
17BEME512	Dynamics and Metrology Laboratory	1	1,2,3,4,6,9,12	0	0	3	2	40	60	100	
17BEME513	Thermal Engineering Laboratory I	1	1,2,3,4,7,11	0	0	3	2	40	60	100	
17BEME514	Course Oriented Project III	-	--	0	0	2	1	100	0	100	
Total				**17**	**5**	**10**	**25**	**420**	**480**	**900**	
VALUE ADDED COURSE											
17BEME551	In–plant training	-	--	-	-	-	-	100	0	100	
17BEME552	Geometrical Dimensioning and Tolerance	-	--	1	0	0	-	100	0	100	

SEMESTER VI											
Course Code	**Course title**	**Objectives & Outcomes**		**Instruction Hours / Week**			**Credits**	**Maximum Marks**			
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**	
								40	**60**	**100**	
17BEME601	Operations Research	1	1,3,5,6,7,8	3	2	0	4	40	60	100	
17BEME602	Design of Transmission System	1	1,2,3,4,8,9,10	3	1	0	3	40	60	100	
17BEME603	Heat and Mass Transfer	1	1,2,3,4,5	3	2	0	4	40	60	100	
17BEME604	Economics for Engineers	1	1,2,3,5,7	3	0	0	3	40	60	100	
17BEME6E– –	Professional Elective III	--	--	3	0	0	3	40	60	100	
17BEME6E– –	Professional Elective IV	--	--	3	0	0	3	40	60	100	
17BEME611	Computer Aided Modeling & Simulation Laboratory	1	1,2,3,4,5,8,9	0	0	3	2	40	60	100	
17BEME612	Thermal Engineering Laboratory II			0	0	3	2	40	60	100	
17BEME613	Mini Project	-	--	0	0	3	2	40	60	100	
Total				**18**	**5**	**9**	**26**	**360**	**540**	**900**	
VALUE ADDED COURSE											
17BEME651	Technical Presentation	-	--	0	0	1	-	100	0	100	

SEMESTER VII

Course Code	Course title	Objectives & Outcomes		Instruction Hours / Week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
17BECC701	Professional Ethics, Principles of Management andEntrepreneurship Development	1	1,2,3,4,5, 10,11	3	0	0	3	40	60	100
17BEME702	Mechatronic Systems	1	1,2,3,4,5	3	0	0	3	40	60	100
17BEME7– –	Professional Elective V	--	--	3	0	0	3	40	60	100
	Open Elective I	--	--	3	0	0	3	40	60	100
	Open Elective II	--	--	3	0	0	3	40	60	100
17BEME711	CAE / CAM Laboratory	1	1,2,3,4,8,9	0	0	3	2	40	60	100
17BEME712	Mechatronics Laboratory	1	1,2,3,4,5,7	0	0	3	2	40	60	100
17BEME791	Project Work - Phase I	-	--	0	0	4	2	40	60	100
Total				**15**	**0**	**10**	**21**	**320**	**480**	**800**
VALUE ADDED COURSE										
17BEME751A 17BEME751B	Robotics and Automation / Motors and Pumps	-	--	1	0	0	-	100	0	100

SEMESTER VIII

Course Code	Course title	Objectives & Outcomes		Instruction Hours / Week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
17BEME801	Total Quality Management	1	1,2,3,4,5,8,9	3	0	0	3	40	60	100
17BEME8– –	Professional Elective VI	--	--	3	0	0	3	40	60	100
17BEME891	Project Work - Phase II & Viva-voce	--	--	0	0	24	12	120	180	300
				6	**0**	**24**	**18**	**200**	**300**	**500**

LIST OF ELECTIVES

PROFESSIONAL ELECTIVES (PE)

SEMESTER V
Elective I & II

Course Code	Course title	Objectives & Outcomes		Instruction Hours / Week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
17BEME5E01	Material Aspects in Design	1,3	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME5E02	Computer Integrated Manufacturing	1,2	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME5E03	Automobile Engineering	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEME5E04	Hydraulics and Pneumatics Power Control	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME5E05	Design of Jigs, Fixtures and Press Tools	1,3	1,2,3,7,9,12	3	0	0	3	40	60	100
17BEME5E06	Renewable Energy Sources	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEME5E07	Industrial Robotics	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEME5E08	Design and Analysis of Experiments	1	1,2,3,7,9,13	3	0	0	3	40	60	100

SEMESTER VI
Elective III & IV

Course Code	Course title	Objectives & Outcomes		Instruction Hours / Week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
17BEME6E01	Power Plant Engineering	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEME6E02	Advanced Manufacturing Processes	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME6E03	Computational Fluid Dynamics	1,3	1,2,3,7,9,12	3	0	0	3	40	60	100
17BEME6E04	Manufacture and Inspection of Gears	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEME6E05	Design for Manufacture and Assembly	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEME6E06	Gas Dynamics and Jet Propulsion	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME6E07	Advanced I.C. Engines	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEME6E08	Finite Element Methods	1	1,2,3,7,13,15	3	0	0	3	40	60	100

SEMESTER VII
Elective V

Course Code	Course title	Objectives & Outcomes		Instruction Hours / Week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
17BEME7E01	Machine Tool Design	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEME7E02	Additive Manufacturing	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEME7E03	Composite Materials	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME7E04	Refrigeration and Air Conditioning	1	1,2,3,7,9,12	3	0	0	3	40	60	100

SEMESTER VIII
Elective VI

Course Code	Course title	Objectives & Outcomes		Instruction Hours / Week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
17BEME8E01	Quality Control and Reliability Engineering	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEME8E02	Production Planning and Control	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEME8E03	Cogeneration and Waste Heat Recovery Systems	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEME8E04	Energy Conservation Methods and Energy Audit	1	1,2,3,7,9,15	3	0	0	3	40	60	100

OPEN ELECTIVES

COURSES OFFERED BY OTHER DEPARTMENTS

SUB. CODE	TITLE OF THE COURSE	PEO	PO	L	T	P	C	CIA	ESE	TOTAL
SCIENCE AND HUMANITIES										
17BESHOE01	Probability and Random Process	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BESHOE02	Fuzzy Mathematics	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BESHOE03	Linear Algebra	1,3	1,2,3,7,9,12	3	0	0	3	40	60	100
17BESHOE04	Engineering Acoustics	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BESHOE05	Solid Waste Management	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BESHOE06	Green Chemistry	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BESHOE07	Applied Electrochemistry	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BESHOE08	Industrial Chemistry	1	1,2,3,7,13,15	3	0	0	3	40	60	100
COMPUTER SCIENCE AND ENGINEERING										
17BECSOE01	Internet Programming	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BECSOE02	Multimedia and Animation	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BECSOE03	PC Hardware and Trouble shooting	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BECSOE04	Java Programming	1	1,2,3,7,9,15	3	0	0	3	40	60	100
ELECTRICAL AND ELECTRONICS ENGINEERING										
17BEEEOE01	Electric Hybrid Vehicles	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEEEOE02	Energy Management & Energy Auditing	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEEEOE03	Programmable Logic Controller	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEEEOE04	Renewable Energy Resources	1	1,2,3,7,9,12	3	0	0	3	40	60	100
ELECTRONICS AND COMMUNICATION ENGINEERING										
17BEECOE01	Real Time Embedded Systems	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEECOE02	Consumer Electronics	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEECOE03	Neural Networks and its Applications	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEECOE04	Fuzzy Logic and its Applications	1	1,2,3,7,9,12	3	0	0	3	40	60	100
BIOTECHNOLOGY										
17BTBTOE01	Bioreactor Design	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BTBTOE02	Food Processing and Preservation	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BTBTOE03	Basic Bioinformatics	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BTBTOE04	Fundamentals of Nano Biotechnology	1	1,2,3,7,9,15	3	0	0	3	40	60	100
AUTOMOBILE ENGINEERING										
17BEAEOE01	Automobile Engineering	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEAEOE02	Basics of Two and Three Wheelers	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEAEOE03	Automobile Maintenance	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEAEOE04	Introduction to Modern Vehicle Technology	1	1,2,3,7,9,15	3	0	0	3	40	60	100
CIVIL ENGINEERING										
17BECEOE01	Housing, Plan and Management	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BECEOE02	Building Services	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BECEOE03	Management of Irrigation Systems	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BECEOE04	Advanced Construction Technology	1	1,2,3,7,9,	3	0	0	3	40	60	100

			15							

COURSES OFFERED TO OTHER DEPARTMENTS

SUB. CODE	TITLE OF THE COURSE	PEO	PO	L	T	P	C	CIA	ESE	TOTAL
17BEMEOE01	Computer Aided Design	1	1,2,3,7,9,15	3	0	0	3	40	60	100
17BEMEOE02	Industrial Safety and Environment	1	1,2,3,7,13,15	3	0	0	3	40	60	100
17BEMEOE03	Transport Phenomena	1	1,2,3,7,9,13	3	0	0	3	40	60	100
17BEMEOE04	Introduction to Biomechanics	1	1,2,3,7,9,15	3	0	0	3	40	60	100

Total number of credits: 189

L:LectureHour	T:TutorialHour	CIA: Continuous Internal Assessment
P:PracticalHour	C: No.ofCredits	ESE: End SemesterExaminations

Note:

1. The passing minimum for value added course is 50 marks out of 100 marks. There will be two tests, of which one will be class test covering 50% of syllabus for 50 marks and other for 50 marks.

2. Credits for value added courses are not counted for computation ofCGPA.

3. Interested students can opt oneself study course in eighth semester from open electives which will be reflected in the mark sheet only if he / shepasses

Programme Educational Objectives (PEO's)

- **PEO1:** Graduates will more conscious about their profession with social awareness and responsibility.

- **PEO2:** Graduates will be engineering experts, who would help solve industry's technological problems.

- **PEO3:** Graduates will be engineering professionals, consultants or entrepreneurs engaged in technology development.

- **PEO4:** Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country.

Programme Outcomes (PO's)

- **PO1:** Ability to apply knowledge of mathematics and science in solving engineering problems.

- **PO2:** In-depth knowledge on the fundamental principles, construction and auxiliary systems of mechanical sciences.

- **PO3:** To understand the principles involved in evaluating the structural, functional and safety requirements of mechanical systems.

- **PO4:** Hands on knowledge to develop analytical skills for designing and analyzing various mechanical components and processes.

- **PO5:** To understand and apply appropriate techniques and IT tools for the design and analysis of mechanical systems.

- **PO6:** Understanding the mechanism of pollutant formation and its control techniques.

- **PO7:** Understanding of human and ethical responsibilities towards the profession and society.

- **PO8:** Ability to understand the economics and cost analysis in order to take economically sound decisions.

- **PO9:** Ability to apply modem techniques and tools necessary for engineering practice with appropriate considerations for public health, safety, cultural and environmental limitations.
- **PO10:** Understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development.
- **PO11:** Function effectively as an individual, and as a member or a leader in diverse teams, and in multi-disciplinary situations.
- **PO12:** To recognize the need for, and have the ability to engage in independent and lifelong learning.

Programme Educational Objectives	Programme Objectives											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1			✓			✓	✓	✓	✓	✓		
PEO2	✓	✓	✓	✓	✓				✓			
PEO3	✓	✓	✓	✓	✓				✓		✓	✓
PEO4								✓			✓	

17BECC101	**COMMUNICATIVEENGLISH**	**3 0 0 3100**

COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professionalcommunication.
2. To make the students to meet the growing demand in the field of Globalcommunication.
3. To help students acquire their ability to speak effectively in real lifesituations.
4. To inculcate the habit of reading and to develop their effective readingskills.
5. To ensure that students use dictionary to improve their active and passivevocabulary.
6. To enable students to improve their lexical, grammatical and communicativecompetence.

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 & writingability.
3. Ensure students proficiency in professionalcommunication.
4. Developed their active and passivevocabulary.
5. Gain confidence in using English language in real lifesituations.
6. Improve word power: lexical, grammatical and communication competence.

UNITI   **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,conversationalandargumentative.**Writing**–FormalandInformalletters-Freewritingonanytopic –My favorite place, hobbies, dreams, goals, etc- - 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.

UNITII   **10**

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 – Writing short messages. **Grammar** – Parts of speech – Noun – Verb – Adjectives - Adverbs. **Vocabulary** – Compound Nouns/Adjectives – Irregular verbs.

UNITIII   **10**

Listening – Listening for specific task – Fill in the gaps. **Speaking** – Phonemes – Syllables – Role play – Conversation Practice. **Reading** – Reading and Comprehension. **Writing** - Autobiographical writing – Biographical writing - Instruction writing. **Grammar** – Preposition – Infinitive – Gerund – Tenses. **Vocabulary** – Foreign words used in English – British and American usage.

UNITIV   **8**

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) Letters to the Editor. **Grammar** – Sentence pattern – Voice (active and passive voice). **Vocabulary** – One word substitution.

UNITV   **8**

Listening -Listening to different accents, speeches/presentations. **Speaking**- Extemporetalk –Just-a-minute talk. **Reading**-Reading strategies–Intensive reading – Text analysis. **Writing** - Creative writing – Writing circulars andnotices –Writingproposal.**Grammar**–DirectandIndirectspeech–Conditionalsentences-Auxiliaryverbs.**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**

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sangeeta Sharma, MeenakshiRaman	Technical Communication: Principles And Practice 2nd Edition	OUP	2015

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2009
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea, J.	Basic Communication Skills for Technology	Pearson Education, New Delhi.	2006

WEB REFERENCES

1. www.learnerstv.com – Listening/ Speaking/Presentation
2. www.usingenglish.com – Writing/Grammar
3. www.englishclub.com – Vocabulary Enrichment/Speaking
4. www.ispeakyouspeak.blogspot.com – Vocabulary Enrichment/Speaking
5. www.teachertube.com – WritingTechnically

1

17BECC102   **ENGINEERING MATHEMATICS – I**   **3 2 0 4 100**

COURSE OBJECTIVES
1. To introduce the basic concepts of PDE for solving standard partial differentialequations
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in varioussituations.
3. To provide an overview of probability and statistics toengineers
4. To introduce the basic concepts of two-dimensional randomvariables
5. To acquaint the knowledge of testing of hypothesis for small and large samples.
6. To apply testing of hypothesis in important role in real lifeproblems.

COURSE OUTCOMES
After successfully completing the course, the student will have a good understanding of the following topics and their applications
1. Thefundamentalconceptsofpartialdifferentialequationsandthevarioussolutionproceduresforsolvingthefirst order non-linear partial differentialequations.
2. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional waveequations.
3. Understand the basic concepts of one knowledge of the concepts of probability and have knowledge of standard distribution which can describe real life phenomenon.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineeringapplications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimentaldata
6. Apply the concept of testing of hypothesis for small and large samples in real lifeproblems.

UNITI   MATRICES   **12**
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 orthogonalreduction.

UNITII   DIFFERENTIALCALCULUS   **12**
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

UNITIII   DIFFERENTIALEQUATIONS   **11**
Linear Differentialequations of second and higher order with constant coefficients - Euler's form of Differential equations – Method of variation parameters.

UNITIV   FUNCTIONS OFSEVERALVARIABLES   **12**
Partial derivatives – Euler's theorem for homogeneous functions – Total derivatives – Differentiation of implicit functions – Jacobians –Maxima and Minima of functions of two or more Variables - Method of Lagrangian multipliers.

UNITV   SEQUENCES ANDSERIES   **13**
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.

                                                                         TOTAL   60

TEXT BOOK

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

17BECC102   **ENGINEERING MATHEMATICS – I**   **3 2 0 4 100**

.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, Bhujanga Rao. M	Engineering Mathematics I	BS Publications, India.	2010
3	Ramana. B.V	Higher Engineering Mathematics	Tata McGraw Hill Publishing Company, New Delhi.	2007
4	Shahnaz Bathul	Text book of Engineering Mathematics	PHI Publications, New Delhi.	2009
5	Michael D. Greenberg	Advanced Engineering Mathematics	Pearson Education, India	2009

WEB REFERENCES
1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants

COURSE OBJECTIVES

1. To introduce the basic physics concepts relevant to different branches of Engineering and Technology.
2. To acquire the knowledge of Electromagnetic field theory.
3. To make the student to learn scientific, mathematical and engineeringprinciples.
4. To make the students to understand the basics of vacuum science.
5. To make the students to understand the process of production and measurement.
6. To make the students to understand the working of Gauges like Pirani,McLeod and Penning

COURSE OUTCOMES

1. Formulate potential problems within electrostatics, magneto statics.
2. Formulate stationary current distributions in linear, isotropic media.
3. Acquire knowledge on properties of matter, quantum physics.
4. Understand the basics of vacuum science.
5. Understand the process of production and measurement.
6. Understand the working of Gauges like Pirani,McLeod and Penning

UNITI   PROPERTIES OF MATTERANDTHERMODYNAMICS   9

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.

UNITII   LASER ANDFIBEROPTICS   9

Introduction – emission and absorption process- Einstein's coefficients derivation. Types of LASER -CO_2, 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)

UNITIII   QUANTUM PHYSICS   9

Introduction to quantum theory – Black body radiation-Photo electric 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 electronmicroscope.

UNITIV   CRYSTALPHYSICS   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 surfacedefects

UNITV   ULTRASONICS ANDNUCLEARPHYSICS   9

Production of ultrasonics by piezoelectric method –Non Destructive Testing – pulse echo system through transmissionandreflectionmodes-A,BandC–scandisplays,Medicalapplications–SonogramIntroduction
– 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 Publication
1	Ganesan.S and Baskar.T	Engineering Physics I	GEMS Publisher, Coimbatore-641 001	2015

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Serway and Jewett	Physics for Scientists and Engineers with Modern Physics	Thomson Brooks/Cole, Indian reprint, New Delhi	2010
2	Gaur, R.K. and Gupta. S.C	Engineering Physics	Dhanpat Rai Publications,New Delhi.	2011
3	M.N. Avadhanulu and PG Kshirsagar	A Text book of Engineering Physics	S.Chand and company, Ltd., New Delhi	2011

WEB REFERENCES

1. www.nptel.ac.in
2. www.physicsclassroom.com
3. www.oyc.yale.edu

COURSE OBJECTIVES

1. To understand the terminologies of atomic and molecularstructure
2. To study the basics of Periodic properties, Intermolecularforces
3. To study about spectroscopictechnique
4. To understand the working of electromagnetic spectrum and spectroscopictechniques
5. To understand the thermodynamicfunctions
6. To comprehend the basic organic chemistry and to synthesis simpledrug.

COURSE OUTCOMES

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states andelectronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopictechniques.
5. Rationalise bulk properties and processes using thermodynamicconsiderations.
6. List major chemical reactions that are used in the synthesis ofmolecules.

UNITI   WATERTECHNOLOGY   9

Sources-Characteristics – Specification for drinking water, BIS &WHO-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 - Reverseosmosis.

UNITII   ELECTROCHEMISTRY ANDSTORAGEDEVICES   9

Electrochemical 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) –Electrolytic conductance-application (conductometric titration)-Batteries- Primary batteries-Leclanche cell-Secondary batteries- Lead acid battery. An introduction to Fuel Cell- H_2-O_2 Fuel Cell.

UNIT III   FUELSANDCOMBUSTION   9

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, Combustion of fuel-Introduction-GCV-NCV-Flue gas analysis.

UNITIV   CORROSIONSCIENCE   9

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions –Inorganic coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hotdipping.

UNITV   SURFACE CHEMISTRY ANDPHASERULE   9

Introduction-Adsorption-Types, adsorption of gases on solids, adsorption of solutes from solutions, Adsorption isotherms-Freundlich adsorption isotherm-Langmuir adsorption isotherm- Role of adsorbents in industries (catalysis and water softening).
Phase Rule: Definition -Phase diagrams – one component water system, two component Ag-Pb system.

                                                        TOTAL   **45**

17BECH103
17BECH203   **ENGINEERING CHEMISTRY**   **3 0 0 3100**

TEXT BOOK

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

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Raman Sivakumar	Engineering Chemistry I &II	McGraw-Hill Publishing Co.Ltd., 3rd Reprint NewDelhi.	2013
2	Kuriakose. J.C. and Rajaram	Chemistry in Engineering and Technology. Vol. I & II 5th edition.	Tata McGraw Hill Publishing Company, New Delhi.	2010

WEB REFERENCES

1. http://www.studynotes.ie/leaving-cert/chemistry/
2. http://www.rejinpaul.com/2011/04/engineering-chemistry-ii-second.html

17BEME104   **BASIC MECHANICAL ENGINEERING**   **3 0 0 3100**

COURSE OBJECTIVES

1. To impart the basic knowledge of various basic fields of mechanicalengineering.
2. To Study about basic manufacturing and machiningprocesses.
3. To study about powerplants.
4. To study about automobileengineering
5. To study about boiler and hydraulic machines.
6. To study about Refrigeration and Airconditioning

COURSE OUTCOMES

1. Design different sheet metal working processes
2. Select appropriate Joining Processes to join Work piece.
3. Differentiate various metal forming processes such as Hot and Cold Working, Rolling, Forging, Extrusion and Drawing Processes.
4. Students will be able to apply these basics in the designing of the automotive components and engines.
5. Students will be able to get employed in Private Companies like Automotive Sector involving Manufacturing and Design as Graduate Trainees Engineer also in government firms like pollution control board.
6. Students should be able to calculate cooling load for air conditioning systems used for various applications

INTRODUCTION (Not includedforexamination)   **3**
Engineering and Technology - History of Mechanical Engineering- Mechanics - Statics and dynamics - Broad areas in Mechanical Engineering.

UNITI   **MANUFACTURINGPROCESSES**   **8**
FOUNDRY - Principles - Patterns - Types, Molding Processes, Cupola and Induction Furnaces. METAL FORMING - Principles - Hot and cold working of metals - Forging, rolling, extrusion and wire drawing, sheet metal operations. WELDING - Principles - Oxy-Acetylene Welding and Manual Metal Arc Welding, Brazing and Soldering.

UNITII METAL FORMING AND JOINING PROCESSES   **8**
Metal forming process – Rolling, forging, drawing, extrusion and sheet metal operations-fundamentals only. Metal joining processes – Welding-arc and gas welding, Soldering and Brazing.

UNIT III   **MACHINING OPERATIONS**   **8**
Machining principles - Construction and working principles of basic machine tools - Lathe, Drilling, Shaper, Planer and Milling machine. Introduction to CNC machines.
Working principle of petrol and diesel engines - Four stroke and two stroke cycles - Comparison between four stroke and two stroke engines - Working principle of simple carburetor - Lubrication system and coolingsystem.

UNITIV   **POWER PLANTS**   **9**
Classification of power plants - Working principle of steam, Gas, Diesel, Hydro - Electric and Nuclear Power Plants - Merits and demerits. Solar – Wind power plants.

UNITV   **REFRIGERATION ANDAIR-CONDITIONING**   **9**
Terminology of Refrigeration and Air Conditioning - Basic principles of Vapour Compression and Absorption Refrigeration System – Window and Split Room Air Conditioners.

                                 TOTAL   **45**

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Shanmugam, G	Basic Mechanical Engineering	Tata McGraw Hill Publishing company Limited, New Delhi	2008
2	Rajput, R.K	Basic Mechanical Engineering	Laxmi Publications (P) Ltd, New Delhi	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	K.R.Gopalkrishna	A text Book of Elements of Mechanical Engineering	Subhash Publishers, Bangalore	2012
2	Pravin Kumar	Basic Mechanical Engineering	Pearson	2013

17BEME105A   **BASIC ELECTRICAL AND ELECTRONICS**   **3 0 0 3100**

COURSE OBJECTIVES
1. To provide an overview of various analogdevice
2. To provide an overview of Digitalconcepts
3. To learn working of amplifier and its application.
4. To understand the concept of RC-timing circuits.
5. To learn cellular concept and block diagram of GSM system.
6. To provide a review of communicationsystem

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the principles of semiconductor devices and theirapplications.
2. Understand the concept of voltageregulators
3. Design an application using Operationalamplifier.
4. Understand the working of timing circuits andoscillators.
5. Understand logic gates, flip flop as a building block of digitalsystems.
6. Learn the basics of Electronic communicationsystem.

UNITI   ELECTRIC CIRCUITS&MEASUREMENTS   9
Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits WaveformsandRMSValue–PowerandPowerfactor–SinglePhaseandThreePhasebalancedCircuits.

UNITII   ELECTRICALMACHINES   9
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNITIII   MEASURINGINSTRUMENTS   9
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNITIV   SEMICONDUCTOR DEVICESANDAPPLICATIONS   9
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

UNITV   DIGITALELECTRONICS   9
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   45

TEXTBOOKS

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	SedhaR.S	Applied Electronics	S. Chand & Co	2006

17BEME105A   **BASIC ELECTRICAL AND ELECTRONICS**   **3 0 0 3100**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Muthusubramanian R, 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	Mahmood Nahvi and Joseph A. Edminister	Electric Circuits	Schaum' Outline Series, McGraw Hill	2002
4	Premkumar N	Basic Electrical Engineering	Anuradha Publishers	2003

COURSE OBJECTIVES
1.   To know about different materials and theirproperties
2.   To know about engineering aspects related tobuildings
3.   To know about importance of surveying and the transportationsystems
4.   To get exposed to the rudiments of engineering related to dams, water supply, and sewagedisposal
5.   To know about importance of drawings
6.   To know about importance of electrical fittings.

COURSE OUTCOMES
1.   Students are able to understand the property,use, advantage and disadvantage of different material used in construction
2.   Students are able to understand the component of building with their function
3.   Students are able to understand construction procedure of different components
4.   After completion of this students will able to understand basic principles of building design andplanning.
5.   They will explore building drawing as a way of discovering and developing ideas for designingresidential, commercial and public buildings.
6.   Students will identify suitable method of irrigation and drainage of waterloggedarea .

UNITI   BUILDINGMATERILAS   9
Introduction – Civil Engineering – Materials: Bricks – composition – classifications – properties – uses. Stone – classification of rocks – quarrying – dressing –properties –uses. Timber – properties – uses –ply wood. Cement – grades –types – properties –uses. Steel – types –properties – uses – market forms. Concrete – grade – properties –uses.

UNITII   BUILDINGCOMPONENTS   9
Building – selection of site – classification – components. Foundations –functions – classifications – bearing capacity. Flooring – requirements – types – cement concrete – marble – terrazzo floorings. Roof – types and requirement

UNITIII   SURVEYING   9
Surveying – objectives – classification – principles of survey – survey instruments , their care and adjustments – Ranjing and Chaining .Compass – types –Prismatic Compass. Bearing – types. Levelling –Levels and staves – types. Contouring

UNITIV   WATER SUPPLY ANDSEWAGEDISPOSAL   9
Dams – purpose – selection of site – types –gravity dam (cross section only). Water supply – objective – quantity of water – sources – standards of drinking water – distribution system. Sewage – classification — septic tank – components andfunctions.

UNITV   BUILDINGDRAWING   9
Types of drawing with appropriate scale & Uses of index map, key plan, village map, site plan, Layout plan –Types of Projection adopted in Building Drawing (Plan, Elevation and sections) – Scales for various types of Drawings– Working drawing, large scale drawing– Symbols, Conventions and Abbreviations for – Electrical fittings , water supply ,sanitary fittings, materials of construction – Sizes of various standard papers.

                                                                TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Raju K.V.B, Ravichandran P.T	Basics of Civil Engineering	Ayyappa Publications, Chennai	2012
2	V. B. Sikka	Civil engineering drawing	B. D. KatariaSons , Ludhiana	2009

17BEME105B   **ELEMENTS OF CIVIL ENGINEERING**   **3 0 0 3100**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Civil Engineering	Ramesh Babu	VRB Publishers, Chennai	2010
2	-	Building Materials	National Building Code of India, Part V	2005
3	Engineering Materials	Rangwala S.C	Charotar Publishing House, Anand	2012

COURSE OBJECTIVES

1. To learn the basic concepts in physics relevant to different branches of Engineering andTechnology.
2. To study the concept of semiconductor andconductivity.
3. To learn the properties ofmaterials.
4. To learn the basic concept of Numerical Aperture and acceptanceangle.
5. To make the students to determination of wavelength usinggrating.
6. To learn the basic concept about viscosity of liquids.

COURSE OUTCOMES

1. Understand the basic concepts in physics relevant to different branches of Engineering andTechnology.
2. Understand the concept of semiconductor andconductivity.
3. Acquire knowledge on the properties ofmaterials.
4. Understand the basic concept of Numerical Aperture and acceptanceangle.
5. Understand the students to determination of wavelength usinggrating.
6. Acquire knowledge on the basic concept about viscosity of liquids.

LIST OF EXPERIMENTS

PHYSICS

1. Determination of velocity of sound and compressibility of liquid – Ultrasonicinterferometer.
2. Determination of wavelength of mercury spectrum – spectrometergrating.
3. Determination of Young's modulus of the material – Non uniform bending (or) Uniformbending.
4. Determination of Viscosity of liquid – Poiseuille'smethod.
5. Spectrometer Dispersive power of aprism.
6. Torsional pendulum – Determination of Rigiditymodulus.
7. Particle size determination using DiodeLaser
8. Determination of Laser parameters – Wavelength, and angle ofdivergence.
9. Determination of acceptance angle in an opticalfiber.
10. Determination of thickness of a thin wire – Air wedgemethod
11. Determination of Band Gap of a semiconductormaterial.
12. Determination of Specific resistance of a given coil of wire – WheatstoneBridge

                                        TOTAL   **45**

COURSE OBJECTIVES

1. To understand the terminologies of atomic and molecularstructure
2. To study the basics of Periodic properties, Intermolecularforces
3. To study about spectroscopictechnique
4. To understand the working of electromagnetic spectrum and spectroscopictechniques
5. To understand the thermodynamicfunctions
6. To comprehend the basic organic chemistry and to synthesis simpledrug.

COURSE OUTCOMES

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states andelectronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopictechniques.
5. Rationalise bulk properties and processes using thermodynamicconsiderations.
6. List major chemical reactions that are used in the synthesis ofmolecules.

LIST OF EXPERIMENTS

CHEMISTRY

1. Estimation of alkalinity of Watersample
2. Estimation of hardness of Water byEDTA
3. Estimation of Chloride in Water sample (Argentometricmethod)
4. Determination of corrosion rate by weight lossmethod.
5. Determination of molecular weight and degree of polymerization usingviscometry.
6. Conductometric Titration (Simple acidbase).
7. Conductometric Titration (Mixture of weak and strongacids).
8. Conduct metric Titration using $BaCl_2$ vs Na_2SO_4.
9. pH Titration (acid &base).
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or$K_2Cr_2O_7$).
11. Determination of water of crystallization of a crystalline salt (Coppersulphate).
12. Estimation of Ferric ion byspectrophotometry.
13. Determination of Chemical OxygenDemand.

                                        TOTAL   **45**

COURSE OBJECTIVES

1. To prepare the students to design a system, component, or process.
2. To meet desired needs within realistic constraints such as economic, environmental, social, and ethical.
3. To make the component with health and safety, manufacturability, andsustainability
4. To prepare the students to communicate effectively and to use the techniques, and skills.
5. To make the students to use modern engineering tools necessary for engineeringpractice.
6. To make the students to assemble different components.

COURSE OUTCOMES

1. The students will gain knowledge of the different manufacturing processes.
2. Fabricate components using differentmaterials.
3. Students will be able to fabricate components with their ownhands.
4. They will also get practical knowledge of the dimensional accuracies and dimensionaltolerances
5. By assembling different components with different processes.
6. They will be able to produce small devices of theirinterest.

PART – A (CIVIL & MECHANICAL)

1. **WELDING**   **6**
   i. Preparation of arc welding of butt joints, lap joints and teejoints.

2. **BASICMACHINING**   **6**
   i. Simple Turning and Taperturning
   ii. Drilling andTapping

3. **SHEETMETALWORK**   **6**
   i. Model making – Trays, funnels,etc.

4. **DEMONSTRATIONON**   **4**
   i. Smithyoperations
   ii. Foundryoperations
   iii. PlumbingWorks
   iv. CarpentaryWorks

PART –B (ELECTRICAL & ELECTRONICS)

5. **ELECTRICALENGINEERING**   **10**
   i. Study of electrical symbols and electricalequipments.
   ii. Construct the wiring diagram for Stair case wiring and Fluorescent lampwiring.
   iii. Construct the wiring diagram for Residential house wiring using switches, fuse, indicator, lamp and energymeter.
   iv. Measurement of electrical quantities – voltage, current, power & power factor in Rload.
   v. Measurement of energy using single phase energymeter.

6. **ELECTRONICSENGINEERING**   **13**
   i. Study of Electronic components– Resistor (color coding), capacitors andinductors.
   ii. Soldering practice – Components Devices and Circuits – Using general purposePCB.
   iii. Study of logic gates AND, OR, NOT, NOR andNAND.
   iv. Study of HWR andFWR.

TOTAL   45

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jeyachandran, K. 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

17BEME113   **ENGINEERING GRAPHICS - I**   **0 0 4 2100**

COURSE OBJECTIVES
1. To make the students to design a system, component, or process to meet desired needs.
2. To prepare the students to design the components with realistic constraints.
3. To make the students to consider economic, environmental, ethical, health and safety when they design.
4. To make the students to design the components with considering manufacturability, andsustainability
5. To prepare the students to communicate effectively using the techniques, skills, and modern engineering tools.
6. To make the students to understand to use necessary for engineeringpractice

COURSE OUTCOMES

The student will alsolearn:
1. Introduction to engineering design and its place insociety
2. Exposure to the visual aspects of engineering design and engineering graphicsstandards
3. Exposure to engineeringcommunication effectively.
4. Exposure to 3D free hand sketching.
5. Acquired the knowledge of projections of points, lines and plane surfaces.
6. Understand the basic concept of projection of solids.

UNITI   INTRODUCTION   9
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.

UNITII   SCALES ANDPLANECURVES   8
SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conics –
Construction of Ellipse, Parabola and Hyperbola by eccentricity method

UNITIII   FREEHANDSKETCHING   9
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.

UNITIV   PROJECTION OF POINTS, LINES ANDPLANESURFACES   9
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.

UNITV   PROJECTIONOFSOLIDS   9
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

                                                          TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Venugopal K and Prabhu Raja V	Engineering Graphics	New Age International Publishers	2009
2	VTU	A Primer on Computer Aided Engineering Drawing	Belgaum	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kumar M S	Engineering Graphics	D D Publications, Chennai	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 drawingsheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation –Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technicaldrawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of TechnicalDrawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – ProjectionMethods.

COURSE OBJECTIVES

1. To know the value of being a human being and the value of being a usefulcitizen
2. To develop a critical ability to distinguish between essence and form, or between what is of value and what is superficial, in life.
3. To move from discrimination to commitment.
4. To recognize and determine the role of engineers in the economic and social development of the society.
5. To develop social responsibility &human professional ethics.
6. To develop the knowledge of social impact of economic liberalization and technology.

COURSE OUTCOMES

1. Identify and analyze an ethical issue in the subject matter under investigation or in arelevant field
2. Identify the multiple ethical interests at stake in a real-world situation or practice
3. Articulate what makes a particular course of action ethically defensibleAssess their own ethical values and the social context of problems
4. Identify ethical concerns in research and intellectual contexts, including academic integrity,use and citation of sources, the objective presentation of data, and the treatment of humansubjects
5. Demonstrate knowledge of ethical values in non-classroom activities, such as servicelearning, internships, and field work
6. integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academicsettings, including focused and interdisciplinary research

UNIT-I   3
Introduction to Yoga-MeaningofYoga – Concept ofYoga-Aim and Objectives ofYoga –
Historyof Yoga -Systems of Yoga. -Stages(Or)Limbs ofYoga

UNIT-II   3
Asanas-Surya Namashkar- Thdasana- VeerabadhraAsana- Trikonasana- Utkatasana- Ardha
Chakrasana- ArdhaKatiChakrasana- Thandasana- Gomugasana-Padmasana- Vajrasana-
Paschimottasana- Matsyendrasana-BavanaMukthasana- SuptaPadhangusthasana- Sethubhandhasana-
Navasana- ArdhaBavanamukthasana- Mathasyasana- Naukasana- Bujangasana- Salabasana-
Makkarasana-Dhanurasana.

UNIT-III   3
AdvanceAsanas-Sirasasana-Garudasana-Natrajasana-Rajakoptasana-Chakrasana-Kukutasana-
Virikshasana-Sarvagasana-Halasana-. Mayurasana.

UNIT-IV   3
Pranayama-Meaning-TypesofPranayama-Bhastrika-Bhramari-Udgeeth-Kabalbhati-Bahya-
AnulomVilom-PranayPranayama-BenefitsofPranayama. Neti-JalaNeti,SutraNeti,Nouli- ThreeTypes,
Douthy-ThreeTypes

UNIT-V   3
Mudras-UsesofMudras- Gyan-Shoonya-Apaan-Prana-Vayu-Prithvi-Linga-Apana-AdiMudra-
-Agni Mudra-SuryaMudra-Varuna-HakiniMudra.

TOTAL   **15**

REFERENCES

S.No	AuthorName	TitleOfBook	Publisher	Year of Publication
1.	Dr.K.Chandrasekaran	Sound Health ThroughYoga	Prem Kalyan	2009
2.	B.K.S.Iyangar	Light On Pranayama	Crossroad Centuary	2013
3.	Thirumular	Thirumandhiram	Sriramakrishna Math	2016

COURSE OBJECTIVES

1. To help students comprehend the role of listening skills in effectivecommunication
2. To familiarize students with verbal and non-verbalcommunication
3. To expose students to neutralaccent
4. To develop emotional intelligence skills in them for enhancing theirself-esteem
5. To assist them in setting goals and developing positiveattitude
6. To enable students to acquire decision making skills, problem solving skills and assertiveskills

COURSE OUTCOMES

1. CO1. To be familiar with the complete course outline/Course Objectives/Learning Outcomes/ Evaluation Pattern & Assignments

2. To participate in an online learning environment successfully by developing the implication-based understanding of Paraphrasing, deciphering instructions, interpreting guidelines, discussion boards & Referencing Styles.

3. To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.

4. To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.

5. To draft effective business correspondence with brevity and clarity.

6. To stimulate their Critical thinking by designing and developing clean and lucid writing skills.

UNITI   **9**

What is Business Communication? - Types of Communication – Formal and informal communication – Process of Communication- modes of Communication – Barriers to communication.

UNITII   **9**

Written Business Communication – Style- word-usage- organisation of Ideas – mechanics of writing and fill up of forms - Cover Letter- Letter for Job Application- Letter of Complaint - Memos - Resumes - Email- Reports Revising and proofreading- Advertising slogans- jargons- Description of Graphics and visual aids - interpretation of graphs using expressions of comparison and contrast .

UNITIII   **9**

Reading and Understanding the news articles - Oral Business Communication - First Impressions - Attire – Effective Presentation strategies- Nuances of delivery – Controlling nervousness and stage fright- Visual aids Presentations- Capturing Audience - Tone - Behavior - Telephone Etiquette- Non - verbal communication - Eye contact - Facial expressions - Posture - Gestures - Body langage – Etiquette- Organization of presentation – brain storming-Negotiations.

UNITIV   **9**

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.

UNITV   **9**

Intrapersonal skills - Self-analysis - Thought process – Interpersonal skills - Confidence building - Resolving conflicts- Analytical skills - Team Building - Leadership skills - Planning/organizing - Ability to work independently - Professional ethics - Communicating via e-mail. Ethical perspectives and their implications for responsible communication - Proposal Presentation

                                                                                TOTAL   **45**

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Meenakshi Raman ; Prakash Singh	Business Communication	Oxford University Press	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Murthy, G .R. K.	Soft Skills for Success.	The ICFAI University Press, Hyderabad.	2008
2	Jagadeesan, G & Santanakrishnan,R.	Soft Skills Development: Training and Evaluation.	The ICFAI University Press, Hyderabad.	2008
3	Sherfield, Robert M., Rhonda J. Montgomery, & Patricia G. Moody	Developing Soft Skills.	Pearson Education, New Delhi.	2005

WEBREFERENCES

1. http://tribehr.com/social-hr-software/talent-management/skills-tracking
2. www.ispeakyouspeak.blogspot.com
3. https://alison.com/subjects/6/Personal-Development-Soft-Skills

COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professionalcommunication.
2. To make the students to meet the growing demand in the field of Globalcommunication.
3. To help students acquire their ability to speak effectively in real lifesituations.
4. To inculcate the habit of reading and to develop their effective readingskills.
5. To ensure that students use dictionary to improve their active and passivevocabulary.
6. To enable students to improve their lexical, grammatical and communicativecompetence.

 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 & writingability.
3. Ensure students proficiency in professionalcommunication.
4. Developed their active and passivevocabulary.
5. Gain confidence in using English language in real lifesituations.
6. Improve word power: lexical, grammatical and communication competence.

UNITI   **10**
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 sentence - Question tags. **Vocabulary** – Homonyms and Homophones.

UNITII   **8**
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.

UNITIII   **9**
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 confusedwords.

UNITIV   **8**
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)

UNITV   **10**
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 Vocabulary with their meanings.

                                                                         TOTAL   **45**
Note:Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sangeeta sharma , Meenakshi Raman	Technical Communication: Principles And Practice 2nd Edition	OUP	2015

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Lakshminarayanan, K.R. & Murugavel, T.	Communication Skills for Engineers	SCITECH Publications, Chennai	2008
2	Rizvi Ashraf, M	Effective Technical Communication	Tata McGraw-Hill, New Delhi.	2007
3	Rutherford Andrea,J.	Basic Communication Skills for Technology 2nd Edition	Pearson Education, New Delhi.	2006

WEB REFERENCES

1. www.learnerstv.com
2. www.usingenglish.com
3. www.englishclub.com

COURSE OBJECTIVES

The objective of this course is

1. To familiarize the prospective engineers with techniques in Multivariate integration.
2. To familiarize the concept of ordinary and partial differential equations and complex variables.
3. To equip the students to deal with advanced level of mathematics and applications.
4. To make the students to formulate and solve problems involving random variables.
5. To equip the students to Understand the basic concepts of one- and two-dimensional random variables.
6. To understand the concept of testing of hypothesis for small and large samples in real life problems.

COURSE OUTCOMES

The students will learn:

1. The mathematical tools needed in evaluating multiple integrals and theirusage.
2. The effective mathematical tools for the solutions of differential equations that model physicalprocesses.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineeringProblems.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

UNITI   MULTIPLEINTEGRALS   11

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

UNITI   VECTORCALCULUS   13

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.

UNITIII   PARTIALDIFFERENTIALEQUATIONS   11

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   ANALYTICFUNCTIONS   12

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, and bilinear transformation.

UNITV   COMPLEXINTEGRATION   13

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).

                                                        TOTAL   60

TEXTBOOKS

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.	2011

REFERENCES

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

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

17BECC204   **ENVIRONMENTAL SCIENCES**   **3 0 0 3100**

COURSE OBJECTIVES
1. To create the awareness about environmental problems amongpeople.
2. To develop an attitude of concern for theenvironment.
3. To motivate public to participate in environment protection andimprovement.
4. To demonstrate proficiency in quantitative methods, qualitative analysis, and critical thinking.
5. To develop writing and oral communication needed to conduct high-level work as interdisciplinary scholars and / orpractitioners.
6. To Learn about the systems concepts and methodologies to analyze and understand interactions.

COURSE OUTCOMES
1. Master core concepts and methods from ecological and physical sciences and their application in environmental problemsolving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies andinstitutions.
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 globalscales.
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, interconnectedworld.

UNIT I   INTRODUCTION TO ENVIRONMENTAL STUDIES ANDNATURAL RESOURCES   9
Definition, Scope and Importance – Need for public awareness -Forest resources: Use and over-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   9
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)

UNIT III   BIODIVERSITY   9
Introduction to biodiversity,Definition-Genetic   diversity,Species   diversityand   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 ofbiodiversity.

UNIT IV   ENVIRONMENTALPOLLUTION   9
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   9
From   Unsustainable to Sustainable development,Urban problems related to energy   sources,   Water conservation, 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

TEXT BOOK

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

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	William P.Cunningham	Principles of Environmental Science	Tata Mc Graw -Hill Publishing Company, New Delhi.	2008
2	Linda D. Williams	Environmental Science Demystified	Tata Mc Graw -Hill Publishing Company Limited, New Delhi.	2005

WEB REFERENCES

1. http://people.eku.edu/ritchisong/envscinotes1.html
2. http://nptel.ac.in/courses.php?disciplineId=1203.www.newagepublishers.com/samplechapter/001281.
3. www.unesco.org/ext/field/beijing/scienceb.htm,
4. www.infinitepower.org/education.htm

17BEME212   **COMPUTER PRACTICEAND PROGRAMMING**   **1 0 4 3100**
                              LABORATORY

COURSE OBJECTIVES
1. To provide an awareness to Computing and CProgramming
2. To know the correct and efficient ways of solvingproblems
3. To learn to develop algorithm for simple problemsolving.
4. To Study, analyze and understand logical structure of a computer program
5. To be able to declare pointers of different types and use the mind defining self- referential structures.
6. To be able to create, read and write to and from simple textfiles.

COURSE OUTCOMES
1. Formulate the algorithms for simpleproblems
2. Translate given algorithms to a working and correctprogram
3. Be able to correct syntax errors as reported by thecompilers
4. Be able to identify and correct logical errors encountered at runtime
5. Be able to write iterative as well as recursiveprograms
6. Be able to represent data in arrays, strings and structures and manipulate them through a program

THEORY:

What is computer- Computer Components- What is C- C Character set- Constants, Variables and Keywords-
General form of C Program - Relational and Logical Operators - Selection Structures- If and nested if - Switch
Case - Loops-Definition and types- Functions- Arrays- Introduction to Strings-Pointers.

PRACTICALS:

1. Working with word Processing, Spreadsheet and presentation software in Linux

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

3. CProgramming:
   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,
   implementation of pointers.

                                        TOTAL   **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	E. Balagurusamy	Computing Fundamentals and C Programming	TMH Education, 5th Edition	2014
2	YashavantKanetkar	Let us C	BPB Publications	2013

COURSE OBJECTIVES
1. To prepare the students to make section of solids like Prism, Cylinder, and Pyramid.
2. To prepare true shape of section.
3. To gain the knowledge on lateral surfaces.
4. To acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. To gain the knowledge on 2D drawing using CAD software.
6. To acquire the knowledge on basics of 3D modeling packages.

COURSE OUTCOMES
1. The students to draw section of solids like Prism, Cylinder, and Pyramid.
2. Students can prepare true shape of section.
3. Students gain the knowledge on lateral surfaces.
4. Students acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. Students gain the knowledge on 2D drawing using CAD software.
6. Students acquire the knowledge on basics of 3D modeling packages.

UNITI   **SECTIONOFSOLIDS**   **9**
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

UNITII   **DEVELOPMENTOFSURFACES**   **9**
Developmentoflateralsurfacesofsimpleandtruncatedsolids–Prisms,pyramids,cylindersandcones–
Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNITIII   **ISOMETRICPROJECTIONS**   **9**
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

UNITIV   **PERSPECTIVEPROJECTIONS**   **9**
Perspective projection of prisms, pyramids, cylinders and cone by visual ray method and vanishing point method.

UNITV   **COMPUTERGRAPHICS**   **9**
Introduction to 3D modeling packages. Drafting practices - modeling of simple engineering components, sections and extraction of 2D drawings.

                                        TOTAL   **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
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

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kumar M S	Engineering Graphics	D D Publications, Chennai	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 drawingsheets.
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation –Lettering.
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technicaldrawings.
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of TechnicalDrawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – ProjectionMethods.

17BEME251   **BUSINESSPLAN**   **1 0 0 -100**

17BEME301 **METHODS OFAPPLIEDMATHEMATICS** **3 1 0 4100**

COURSE OBJECTIVES
1. To introduce the basic concepts of PDE for solving standard partial differentialequations
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in varioussituations.
3. To provide an overview of probability and statistics toengineers
4. To introduce the basic concepts of two-dimensional randomvariables
5. To acquaint the knowledge of testing of hypothesis for small and large samples.
6. To apply testing of hypothesis in important role in real lifeproblems.

COURSE OUTCOMES
After successfully completing the course, the student will have a good understanding of the following topics and their applications
1. Thefundamentalconceptsofpartialdifferentialequationsandthevarioussolutionproceduresforsolvingthefirst order non-linear partial differentialequations.
2. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional waveequations.
3. Understand the basic concepts of one knowledge of the concepts of probability and have knowledge of standard distribution which can describe real life phenomenon.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineeringapplications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimentaldata
6. Apply the concept of testing of hypothesis for small and large samples in real lifeproblems.

UNITI **LAPLACETRANSFORM** **13**
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.

UNITII **FOURIERSERIES** **12**
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.

UNITIII **FOURIERTRANSFORM** **12**
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

UNITIV **APPLICATIONS OF PARTIALDIFFERENTIALEQUATIONS** **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)

UNITV **Z -TRANSFORM ANDDIFFERENCEEQUATIONS** **11**
Z-transform - Elementary properties – Inverse Z- transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL **60**

TEXT BOOKS

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.	John Wiley & Sons. Singapore	2014

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

WEB REFERENCE

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

COURSE OBJECTIVES
1. To develop capacity to predict the effect of force and motion.
2. To understand the importance of free body diagram for complex machine structure.
3. To perform force analysis using law of mechanics.
4. To introduce the concepts of static equilibrium condition for particles and rigid bodies
5. To Understand the concepts of kinematics of particles and friction.
6. To make the students conversant to solve the problems using equation of motions.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the basic concepts of force and laws of mechanics.
2. Develop free body diagram for complex machine structure and to perform force analysis.
3. Apply static equilibrium condition for particles and rigid bodies.
4. Locate the center of gravity and moment of inertia for planes and solids.
5. Understand the concepts of kinematics of particles and friction.
6. Solve the problems using equation of motions.

UNIT I STATICSOFPARTICLES   **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 INTWO DIMENSIONS   **12**

Rigid bodies–moment of force about an axis–moments and couples–equivalent system of coplanar forces– Rigid body in equilibrium–problems involving equilibrium of rigid body–types of supports–reactions of beams.

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENTOFINERTIA   **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 OFPARTICLES   **12**

Introduction – plane, rectilinear motion – time dependent motion – rectangular coordinates – projectilemotion.

IMPULSE AND MOMENTUM: Concept of conservation of momentum – Impulse–Momentum principle–Impact – Direct central impact – Oblique central impact – Impact of elastic bodies.

UNIT V KINETICS OF PARTICLESANDFRICTION   **12**

KINETICS OF PARTICLES: Equations 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.

Laws of friction – coefficient of friction–problems involving dry friction – wedge and ladder friction.

TOTAL   60

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Beer F P and Johnson E.R	Vector Mechanics for Engineers–Statics and Dynamics	Tata Mc–Graw Hill Publishing Co. Ltd., New Delhi	2015
2	Rajasekaran.S and Sankarasubramanian G	Engineering Mechanics–Statics and Dynamics	Vikas Publishing House Pvt. Ltd., New Delhi	2009

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Bansal R K	Engineering Mechanics	Laxmi Publications Pvt. Ltd., New Delhi	2015
2	Young D H and Timashenko S	Engineering Mechanics	Tata McGraw–Hill, New Delhi	2013
3	JivanKhachane and Ruchi Shrivastava	Engineering Mechanics: Statics and Dynamics	ANE Books, New Delhi	2006

WEB REFERENCES

1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT%20Guwahati/engg_mechanics/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=112103108
3. http://web.mit.edu/emech/dontindex–build/index.html
4. http://www.indiabix.com/engineering–mechanics/questions–and–answers/

COURSE OBJECTIVES
1. To familiarize the students to apply suitable molding and casting methods for producing components.
2. To develop anunderstanding of types of metal joining processes.
3. To explain types of deformation processes.
4. To understand the concept of sheet metal operations and metal forming processes.
5. To provide an overview of various plastic component manufacturing processes for various applications.
6. To Study and acquire knowledge of process variables to manufacture defect free products

COURSE OUTCOMES
1. Apply suitable molding and casting methods for producing components.
2. Decide the type of metal joining processes.
3. Select the type of deformation processes.
4. Work with various sheet metal operations and metal forming processes.
5. Select the various plastic component manufacturing processes for various applications.
6. Identify the effect of process variables to manufacture defect free products.

UNITI   METALCASTINGPROCESSES   9
Introduction to Sand casting – Sand moulds – Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Types – CO_2 process - Moulding machines – Types of moulding machines – Types of melting furnaces (cupola, induction) – Working principle of Special casting processes – Shell moulding, Investment casting, Pressure die casting, Centrifugal casting – Casting defects – Inspectionmethods.

UNITII   JOININGPROCESSES   9
Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials and properties – Arc welding equipments – Electrodes – Coating and specifications – Principles of Resistance welding – Gas metal arc welding – Submerged arc welding – TIG, MIG welding – Friction Stir Welding – Weld defects – Brazing and soldering process.

UNITIII   BULKDEFORMATIONPROCESSES   9
Hot working and cold working of metals – Ingots – Forging processes – Open, impression and closed die forging – Types of Forging Machines – Rolling of metals – Types of Rolling mills – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing — Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion — Equipments used.

UNITIV   SHEETMETALPROCESSES   9
Sheet metal characteristics – Press – Types of press – Principle of punching, blanking, coining, piercing, notching, embossing – Typical shearing operations, bending, drawing and deep drawing operations – Metal spinning, Stretch forming operations – Formability of sheet metal – Test methods.

UNITV   MANUFACTURING OFPLASTICCOMPONENTS   9
Types of plastics – Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of – Injection moulding – Plunger and screw machines – Compressionmoulding,Transfermoulding–Typicalindustrialapplications–IntroductiontoBlowmoulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TOTAL   **45**

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	SeropeKalpajian, Steven R.Schmid	Manufacturing Engineering and Technology (Second Indian Reprint)	Pearson Education, Inc., New Delhi	2013
2	S.Gowri, P.Hariharan, and A.Suresh Babu	Manufacturing Technology 1	Pearson Education, Inc., New Delhi	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	P.N. Rao	Manufacturing Technology Second Edition	Tata McGraw–Hill Publishing Limited, New Delhi	2013
2	P.C. Sharma	A text book of production technology Fourth Edition	S. Chand and Company, New Delhi	2007
3	Begman	Manufacturing Process Eighth Edition	John Wilely and Sons	2005

WEB REFERENCES
1. www.themetalcasting.com
2. www.industrialmetalcastings.com
3. www.purolator–lp.com
4. www.manufacturercompanies.com/manufacturers

COURSE OBJECTIVES
1. To enrich the understanding of fluid properties
2. To make the students conversant with types of flow and calculate Major and minor loses in pipes.
3. To acquaint the student with the concepts of Buckingham's π theorem.
4. To explain the working of different pumps
5. To explain the working of different turbines.
6. To equip students with skills to produce analytical solutions to various simple problems

COURSE OUTCOMES
1. Demonstrate basic knowledge of fluid properties
2. Find types of flow and calculate Major and minor loses in pipes.
3. Apply Buckingham's π theorem for problem solving.
4. Understand the working of different pumps
5. Understand the working of different turbines.
6. produce analytical solutions to various simple problems

UNITI   FLUID PROPERTIES ANDFLOWCHARACTERISTICS   **12**

Fluid properties: Mass density, weight density, specific gravity, viscosity, compressibility, surface tension and capillarity. Buoyancy and floatation– metacentre and metacentric height (definition only)
Flow   characteristics: concepts of system and   control volume, application of control volume to continuity equation, energy equation, momentum equation and moment ofmomentum equation.

UNITII   FLOW THROUGHCIRCULARPIPES   **12**

Hydraulic and energy gradient – Types of fluid flow – Laminar flow through circular conduits – Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor – Moody diagram – commercial pipes – minor losses – Flow through pipes in series and parallel.

UNITIII   DIMENSIONALANALYSIS   **12**

Dimension and units, dimensional homogeneity, applications of Buckingham's π theorem, model and similitude, similaritylaws.

UNITIV   HYDRAULICTURBINES   **12**

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

UNITV   HYDRAULICPUMPS   **12**

Classification of pumps – centrifugal pump–working principle–head, discharge, efficiencies and losses – performance curves – specific speed. Reciprocating pump–components and working–slip–indicator diagram – air vessel – Jet pump – Gear pump – Submersible pump.

<div align="right">

TOTAL   60

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TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Streeter V.L, Wylie E.B	Fluid Mechanics	McGraw–Hill, New Delhi	1998
2	Kumar K.L	Engineering Fluid Mechanics	S. Chand	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Bansal. R.K	Fluid Mechanics and Hydraulics Machines	Laxmi publications (P) Ltd, New Delhi	2015
2	White. F.M	Fluid Mechanics	Tata McGraw–Hill, New Delhi	2010
3	Fox and McDonald	Fluid Mechanics	John Wiley	2015

WEB REFERENCES
1. www.imeche.org
2. openlibrary.org
3. nptel.iitg.ernet.in
4. www.tecquipment.com

17BEME305A   ELECTRICAL DRIVES AND CONTROLS   3 0 0 3100

COURSE OBJECTIVES

1. To understand the basic concepts of different types of electrical machines and theirperformance.
2. To study the different methods of starting D.C motors and inductionmotors.
3. To study the conventional and solid-statedrives
4. To expose students to the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
5. To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
6. To provide strong foundation to asses performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.

COURSE OUTCOMES

1. Examine various applications in industrial and domestic areas where use of electric drives isessential.

2. Classify types of electric drives systems based on nature of loads, control objectives,performance and reliability.

3. Combine concepts of previously learnt courses such as, electrical machines, Control and powerelectronics to cater to the need of automations in industries.

4. Select most suitable type and specification of motor drive combination for efficient conversionand control of electric power.

5. Identify the critical areas in application levels, and derive typical solutions.

6. Design and justify new control and power conversion schemes for implementing alternativesolutions considering the critical and contemporary issues.

UNITI   INTRODUCTION   9
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors. Multi quadrant operation.

UNITII   DRIVEMOTORCHARACTERISTICS   9
Mechanical and electrical characteristics of various types of load and drive motors – Braking of Electrical motors – DC Shunt, series Motors – Three phase induction motors.

UNITIII   STARTINGMETHODS   9
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNITIV   SPEED CONTROLOFD.C. DRIVES   9
SpeedcontrolofDCseriesandshuntmotors–Armatureandfieldcontrol,Ward-Leonardcontrolsystem–
Using controlled rectifiers and DC choppers –applications.

UNITV   SPEED CONTROL OFA.C.DRIVES   9
Speed control of three phase induction motor – Voltage control, voltage / frequency control, Rotor resistance control –slip power recovery scheme – Using inverters, Cyclo converter and AC voltage regulators –static slip power recovery schemes – applications.

                                                                      TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Vedam Subramaniam	Electric Drives (concepts and applications)	Tata McGraw-Hill, New Delhi.	2001
2	Nagrath I.J. and Kothari D.P,	Electrical Machines	Tata McGraw- Hill, New Delhi	2004

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Pillai.S.K,	A first course on Electric drives	Wiley Eastern Limited, New Delhi.	1998.
2	Singh M.D and Khanchandani K.B,	Power Electronics	Tata McGraw-Hill, New Delhi.	2003
3.	Gopal K.Dubey	Fundamentals of Electrical drives	Narosa Publishing House	2003

17BEME305B   ELECTRONICS AND MICROPROCESSORS   3 0 0 3100

COURSE OBJECTIVES
1. To provide an overview of various analogdevice
2. To provide an overview of Digitalconcepts
3. To learn working of amplifier and its application.
4. To understand the concept of RC-timing circuits.
5. To learn cellular concept and block diagram of GSM system.
6. To provide a review of communicationsystem

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the principles of semiconductor devices and theirapplications.
2. Understand the concept of voltageregulators
3. Design an application using Operationalamplifier.
4. Understand the working of timing circuits andoscillators.
5. Understand logic gates, flip flop as a building block of digitalsystems.
6. Learn the basics of Electronic communicationsystem.

UNITI   SEMICONDUCTORSANDRECTIFIERS   9

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristicsHalf wave and full wave rectifiers -Voltage regulation

UNITII   TRANSISTORSANDAMPLIFIERS   12

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, DIAC, TRIAC, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNITIII   DIGITALELECTRONICS   9

Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNITIV   8085MICROPROCESSOR   9

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set Addressing modes-Simple programs using arithmetic and logical operations.

UNITV   INTERFACING AND APPLICATIONSOFMICROPROCESSOR   6

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Milman and Halkias	Integrated Electronics	Tata McGraw-Hill publishers	1995
2	Ramesh Goankar	Microprocessor Architecture - Programming and Applications with 8085	Wiley Eastern	1998

REFERENCES

17BEME305B   **ELECTRONICS AND MICROPROCESSORS**   **3 0 0 3100**

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Malvino and Leach	Digital Principles and Applications	Tata McGraw-Hill	1996
2	Mehta V.K	Principles of Electronics	S. Chand and Company Ltd	1994
3.	DouglesV.Hall	Microprocessor and Interfacing	Tata McGraw-Hill	1999
4	Salivahanan S, Suresh Kumar N, Vallavaraj A	Electronic Devices and Circuits	Tata McGraw-Hill	1999

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

COURSE OUTCOMES
1. Calculate the coefficient of discharge for Orifice meter and Venturimeter.
2. Calibrate the Rotameter
3. Estimate the friction factor for flow through pipes.
4. Asses the performance of centrifugal pump and submergible pump.
5. Asses the performance of reciprocating pump and gear pump.
6. Asses the performance of turbines

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orificemeter.

2. Determination of the Coefficient of discharge of givenVenturimeter.

3. Calculation of the rate of flow using Rotameter.

4. Determination of friction factor for a given set ofpipes.

5. Conducting experiments and drawing the characteristic curves of centrifugalpump

6. Conducting experiments and drawing the characteristic curves of submersiblepump

7. Conducting experiments and drawing the characteristic curves of reciprocatingpump.

8. Conducting experiments and drawing the characteristic curves of Gearpump.

9. Conducting experiments and drawing the characteristic curves of Peltonwheel.

10. Conducting experiments and drawing the characteristics curves of Francisturbine.

                                                    TOTAL   **45**

COURSE OBJECTIVES
1. To explain the surfaces for sheet metal working applications.
2. To Understand the representation of details in machine drawing.
3. To introduce tolerances and fits of machine elements.
4. To equip them with skills to Construct an assembly drawing using part drawings of machine components.
5. To equip them with skills to Construct an assembly drawing of machine components using 2D drafting.
6. To equip them with skills to Construct an assembly drawing of jigs and fixtures

COURSE OUTCOMES
1. Draw the surfaces for sheet metal working applications.
2. Understand the representation of details in machine drawing.
3. Represent tolerances and fits of machine elements.
4. Construct an assembly drawing using part drawings of machine components.
5. Construct an assembly drawing of machine components using 2D drafting
6. Construct an assembly drawing of machine components of jigs and fixtures.

INTRODUCTION   3
Introduction to machine drawing. Importance of sectional views. Computer-aided drafting.

CONVENTIONS   6
Code of practice for engineering drawing-conventional representation of details- 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 andflanges.

FITSANDTOLERANCES   6
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. Blue print reading exercises.

ASSEMBLY DRAWINGPRACTICE   15
Making free hand sketches of typical subassemblies-flange coupling, stuffing box, journal bearings, rolling element bearings, keyed joints, cotter joints, C clamp.

ASSEMBLY USING2DDRAFTING   15
Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing and Drill jigs and Milling fixture.

                                                           TOTAL   **45**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gopalakrishna K R	Machine Drawing	Subhas Stores, Bangalore	2003
2	Bhatt N. D and Panchal V.M	Machine Drawing	Charotar Publishing House, Chennai	2007
3	ASME Y 14.5M-1994	Dimensioning and Tolerancing	ASME, New York	1995

17BEME313   ELECTRICAL DRIVES AND MICROPROCESSOR   0 0 3 2100
LABORATORY

COURSE OBJECTIVES

1. **To provide students the creative application of scientific principles to design or develop structures, machines, apparatus or works.**

2. To train students with good scientific and technical breadth so as to embody inventions and put his ideas in concrete terms and design something that promotes and helps in fulfilling the ever expanding energy requirements.

3. To inculcate in students professional and ethical attitude, Communication Skills, teamwork Skills, computer programming skill and an ability to relate engineering issues to broader social context.

4. To provide the excellent learning environment, which can enhance the learning ability of student to generate awareness of surrounding, attentiveness to details, experimental analysis.

5. To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics

6. To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

COURSE OUTCOMES

1. Graduates will demonstrate an ability to identify, formulate, pinpoint and solve Electrical engineering problems keeping in view the present-day power and energy requirement and its future prospect.

2. Graduates will demonstrate an ability to design study and analyze the digital and analog systems and components that serve as the fundamental components of the power engineering methods being increasingly used with the new technological advances.

3. Graduate will understand the impact of engineering solutions on the society and also be aware of contemporary issues relating to the exhausting resources and alternatives to continue uninterrupted power supply.

4. Graduate will be able to communicate effectively in both verbal and written form. They will develop a better presentation skill on academic and personal grounds that will enhance their personality in all aspects.

5. Graduates will demonstrate knowledge of professional and computer language skills that will eventually develop them into skilled researchers in an atmosphere that is technically advanced and conductive.

6. Graduates will demonstrate knowledge of advanced mathematics, science and electrical engineering with the ability to apply the theoretical knowledge and concepts to the disciplines of electrical engineering.

LIST OF EXPERIMENTS

ELECTRICAL MACHINES

1. Load Test on DC ShuntMotor
2. Load Test on DC SeriesMotor
3. Load Test on DC CompoundMotor
4. Speed control of D.C. motor. (Armature and Fieldcontrol)
5. Speed control of three phase Induction motor. (VoltageControl)
6. Speed control of three phase Induction motor. (Voltage / frequencyControl)
7. Load test on single phase InductionMotor.
8. Load test on three phase InductionMotor.
9. Speed control of three phase slip ring Induction Motor.

17BEME313   **ELECTRICAL DRIVES AND MICROPROCESSOR**   **0 0 3 2100**

MICROPROCESSOR

1.   Addition of two 8 – bit numbers, sum of 8 – bits and 16bits.
2.   8 - bitsubtraction.
3.   Additional of two 16 – bit numbers, Sum: 16 bits or more.
4.   8 – bit Multiplication.
5.   8 – bit Division.

                                        TOTAL   **45**

17BEME314   **COURSE ORIENTEDPROJECTI**   **0 0 2 1100**

COURSE OBJECTIVES

1. To understand the basic concepts of QUANTITATIVE ABILITY
2. To understand the basic concepts of LOGICAL REASONING Skills
3. To acquire satisfactory competency in use of VERBAL REASONING
4. To solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. To solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. To compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

COURSE OUTCOMES
1. Understand the basic concepts of QUANTITATIVE ABILITY
2. Understand the basic concepts of LOGICAL REASONING Skills
3. Acquire satisfactory competency in use of VERBAL REASONING
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. Solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

UNITI   **5**
        Introduction, Speed Math's, Problems on Numbers, Averages, Ratios and Proportions, Problems on Ages

UNITII   **5**
        Percentage, Data Interpretation, Profit and loss, Simple and Compound Interest

UNITIII   **5**
        Time Speed and Distance, Time and Work, Pipes and Cistern, Geometry, Probability, Permutation and Combination

                                                            TOTAL   **15**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Agarwal.R.S	Quantitative Aptitude for Competitive Examinations	S.Chand Limited	2011
2	Abhijit Guha	Quantitative Aptitude for Competitive Examinations	Tata McGraw Hill	2011
3	Edgar Thrope	Test Of Reasoning for Competitive Examinations	Tata McGraw Hill, 4th Edition	2012

SEMESTER IV

17BEME401   STRENGTHOFMATERIALS   3 1 0 4100

COURSE OBJECTIVES
1. To understand the concepts of stress and strain on deformation of solids.
2. To introduce the Concepts of safe working stresses and load carrying capacity of beams.
3. To enrich the understanding of deflection in beams and columns in engineering applications.
4. To understand the importance of the effect of torsion on shafts and springs.
5. To provide knowledge on principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. To provide knowledge on components subjected to various loadings with the help of various theories of failures.

COURSE OUTCOMES
1. Determine stress and strain on deformation of solids.
2. Compute safe working stresses and load carrying capacity of beams.
3. Estimate the deflection in beams and columns in engineering applications.
4. Analyze the effect of torsion on shafts and springs.
5. Determine principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. Design the components subjected to various loadings with the help of various theories of failures.

UNIT I   STRESS, STRAIN AND DEFORMATIONOFSOLIDS   12
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 uniaxialloads.

UNIT II   BEAMS – LOADS AND STRESSES   12
Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Relationship between load, shear force and bending moment – 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 – Shearflow.

UNIT III   BEAMDEFLECTION   12
Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Macaulay Method – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine's formula for columns

UNIT IV   TORSION   12
Analysis of torsion of circular bars – Torsional Shear stress – Bars of solid and hollow circular section – Stepped shaft – Torsional rigidity – 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

UNITV   ANALYSIS OF STRESSES INTWODIMENSIONS   12
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.

                                     TOTAL   60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Punmia B.C and Jain A.K	Strength of Materials and Theory of Structures – Vol.1	Laxmi Publications New Delhi	2015
2	Ramamrutham S and Narayan R	Strength of Materials	Dhanpat Rai and Sons., New Delhi	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jindal U C	Textbook on Strength of Materials	Asian Books Pvt, Ltd, Chennai	2012
2	Don H Morris, and Leroy D Sturges	Mechanics of Materials	John Wiley and Sons Inc	2006
3.	Bedi D S	Strength of Materials	S Chand and Co. Ltd., New Delhi	1984

WEB REFERENCES

1. www.engineersedge.com
2. http://en.wikiversity.org
3. www.globalsources.com
4. www.dspace.cusat.ac.in

COURSE OBJECTIVES
1. To Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. To understand the concept of constructional features of different types of lathe and their operations.
3. To provide knowledge on construction & working of shaping, milling &drilling machines and gear cutting & finishing process.
4. To expose students to various types of grinding machines and broaching machines.
5. To Explain the construction features of different types of CNC machine and manual part programming for a given component.
6. To Perform part programming for CNC machines.

COURSE OUTCOMES
1. Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. Discuss about the constructional feature of different types of lathe and their operations.
3. Describe the construction & working of shaping, milling &drilling machines and gear cutting & finishing process.
4. Illustrate the various types of grinding machines and broaching machines.
5. Explain the construction feature of different types of CNC machine and manual part programming for a given component.
6. Perform part programming for CNC machines

UNIT I   THEORY OF METAL CUTTING ANDCUTTINGTOOLS   9
Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, oblique cutting – Cutting tool materials, tool wear, tool life, surface finish, cutting fluids, heat generation, Merchant circle.

UNIT II   CENTRE LATHE AND SEMIAUTOMATIC LATHES   9
Centre lathe– constructional features, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle – Tool layout for Capstan, Turret and Automats.

UNIT III   RECIPROCATING MACHINE TOOLS &MILLINGMACHINES   9
Shaper – construction, working, work and tool holding device, quick return mechanism, planer – construction, working, mechanism, operations. Slotter – construction, working.
Milling machine – constructions, types, Indexing mechanism, operations, milling cutter, gear hobbing – principle.

UNIT IV   OTHERMACHINETOOLS   9
Drilling – types, radial drilling machine, construction, operations, Boring, types, Jig boring machine – construction, operations, Broaching – types, construction, Grinding – grinding wheel, specifications and selection, cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing.

UNITV   CNC MACHINES   9
CNC Machines – Construction – Types of control systems, Manual Part Programming – Computer assisted part programming – Computer aided part programming, Machining centers – principle, Turning centers – principle, CAD/CAM & Integration, Application of CNC Machines.

                                                        TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hajra Choudhury	Elements of Workshop Technology Vol– II	Media Promotors Pvt Ltd., Mumbai	2010
2	HMT	Production Technology	Tata McGraw–Hill	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	P.C. Sharma	A text book of production technology	S. Chand and Co. Ltd	2014
2	Shrawat N.S. and Narang J.S	CNC Machines	Dhanpat Rai and Co	2002
3.	P.N.Rao	CAD/CAM Principles and Applications'	TATA Mc Craw Hill	2012
4	Milton C.Shaw	Metal Cutting Principles Second Edition	Oxford University Press	2005

WEB REFERENCES

1. www.steelonline.co.in
2. http://mmu.ic.polyu.edu.hk
3. www.waterjetindiana.com
4. www.teskolaser.com
5. www.cncinformation.com
6. www.cncmachineprogramming.net

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

UNIT I   BASIC CONCEPTS AND FIRSTLAW   12

Basic concepts - Classical and Statistical approaches - Thermodynamic systems - closed, open, isolated. Property – State - Process-adiabatic - Quasi-static process – Cycle - Point and Path function – Energy - Work transfer - Concept of temperature and heat- Zeroth law of thermodynamics - Concept of ideal gases - First law of thermodynamics –PMM1, internal energy, specific heat capacities, enthalpy, and its application to closed system and open system-steady flow energyequation.

UNIT II   SECOND LAWAND ENTROPY   12

Physical description of the second law - Kelvin-Planck and Clausius statements –Equivalence - Reversible processes and cycles- Carnot cycle – Corollaries - Absolute temperature scale – Clausius Theorem, inequality - Entropy- Principle, transfer, generation, balance - Third law of thermodynamics

UNIT III   PROPERTIES OF PURE SUBSTANCE AND GAS MIXTURES   12

Puresubstance-Phasechangeprocess-Propertydiagrams-PVTsurface-Steam–types,drynessfraction-Avogadro's
law - Ideal Gas - Equations of state-Vander Waal's equation - Real Gas - Compressibility and its chart - Mixtures ofGases – Properties.

UNIT IV   THERMODYNAMIC AVAILABILITYANDRELATIONS   12

Basics-Dead state, quality of energy, degradation of energy - Reversible processes – Maximum work - Exergy – Closed system - Steady flow system – Irreversibility - Exergy Balance - Second law efficiency – Exact differentials - Tds Relations - Maxwell's Relation – Clausius – Clapeyron Equation - Joule-Thompson Coefficient.

UNITV   PSYCHROMETRY   12

Psychrometry - Psychrometric charts - Property calculations of air vapour mixtures- Psychrometric process-Adiabatic mixing - Evaporative cooling.

                                        TOTAL   60

(Permitted to use standard thermodynamic table, Mollier diagram, and Psychometric chart in the examination)

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nag P K	Engineering Thermodynamics	Tata McGraw-Hill, New Delhi	2013
2	Cengel	Thermodynamics-An Engineering Approach	Tata McGraw-Hill, New Delhi	2014

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Holman J P	Thermodynamics	McGraw-Hill, NewDelhi	1988
2	Venwylen and Sontag	Classical Thermodynamics	Wiley Eastern, New Delhi	1994
3.	Kothandaraman C P and Domkundwar S	Engineering Thermodynamics	Dhanpatrai& Sons, New Delhi	2004

WEB REFERENCES
1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT%20Guwahati/engg_mechanics/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=112103108
3. http://web.mit.edu/emech/dontindex–build/index.html
4. http://www.indiabix.com/engineering–mechanics/questions–and–answers/

COURSE OBJECTIVES
1. To understand the metallurgical aspects of metals.
2. To provide knowledge to identify suitable heat treatment processes for various applications.
3. To Understand the properties of ferrous and non-ferrous materials.
4. To expose students to suitable strengthening mechanisms for non-ferrous alloys.
5. To enrich the understanding of properties of non-metallic materials.
6. To provide knowledge on suitable materials for various applications.

COURSE OUTCOMES
1. Identify the metallurgical aspects of metals.
2. Identify suitable heat treatment processes for various applications.
3. Understand the properties of ferrous and non-ferrous materials.
4. Identify suitable strengthening mechanisms for non-ferrous alloys.
5. Understand the properties of non-metallic materials.
6. Select the suitable material for various applications.

UNITI   CONSTITUTION OF ALLOYS ANDPHASEDIAGRAMS   9
Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide equilibrium diagram -Classification of steel and cast Iron, microstructure, properties and applications.

UNITII   HEATTREATMENT   9
Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on TTT diagram,CCT
- Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening, Microstructure study and specimen preparation.

UNITIII   FERROUS AND NONFERROUS METALS   9
Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti& W) - stainless and tool steels – HSLA - maraging steels – Gray, White malleable, Spheroidal Graphite irons - Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation, strengthening treatment – Bearing alloys.

UNITIV   NON-METALLICMATERIALS   9
Polymers – types of polymer, commodity and engineering polymers – Properties and Applications of thermoplastics (PP, PVC, ABS, and PMMA) and thermosetting plastics (PF, UF, MF) –Engineering Ceramics.

UNITV   TESTING OF MECHANICAL PROPERTIESANDINSPECTION   9
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 creep test, S-N curve.

Non Destructive Testing: Non Destructive Testing basic principles and testing method of Radiographic testing, Ultrasonic testing, Magnetic particle test and Liquid penetrant test, Eddy current testing.

                                                TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kenneth G.Budinski and MichaelK.Budinski	Engineering Materials	Prentice-Hall of India Private Limited, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	William D. Callister & David G. Rethwisch	Material Science and Engineering	John Wiley and Sons, Delhi	2013
2	Raghavan.V	Materials Science and Engineering	Prentice Hall of India Pvt., Ltd, New Delhi	2015
3.	Shackelford. J.F	Introduction to Materials Science for Engineers	Pearson Edition	2014

WEB REFERENCES:
1. www.materials.unsw.edu.au
2. ocw.MIT.edu
3. www.istl.org
4. metalurgy-screw-tutorial.tobyavujo.com

COURSE OBJECTIVES

1. To impart knowledge on metallurgical aspects ofmetals.
2. To understand heat treatment processes on different grades ofsteel.
3. To familiarize on selection of ferrous and non-ferrous materials for variousapplications.
4. To impart knowledge on non-metallicmaterials
5. To learn about the strengthening mechanisms for Non-ferrousalloys.
6. To comprehend the significance of Non Destructive Testing (NDT)methods.

COURSE OUTCOMES

Learners should be ableto

1. Identify the metallurgical aspects ofmetals.
2. Identify suitable heat treatment processes for variousapplications.
3. Select appropriate ferrous and non-ferrous materials for variousapplications.
4. Identify and select suitable non-metallicmaterials.
5. Identify suitable strengthening mechanisms for Non-ferrousalloys.
6. Work with non destructive testingmethods.

UNITI   INTRODUCTION TO ENGINEERINGMATERIALS   9

Atomic bonding and Crystal structure of engineering materials. Chemical and Physical properties of engineering materials. Mechanical Properties and Behaviours of Materials – Stress - Strain Relationships, Tensile Strength, Hardness, Impact Strength, Fatigue & Stress Rupture, Creep & Stress Rupture, Comparison of Material Properties

UNITII   FERROUS METALS ANDTHEIRPROPERTIES   9

Iron - Carbon Equilibrium Diagram, Carbon Steel & AISI Numerical Identification Systems. Properties, processing and applications of Alloy Steel, Tool Steel, Stainless Steel. General characteristics of metal alloys, Fundamentals of heat treatment and the use of TTT diagrams. Production, forming, and joining of metals.

UNITIII   NONFERROUSMETALS   9

Properties, processing and applications of Aluminum, Magnesium & Titanium, Copper and its Alloys, Low Melting Temperature Alloys. Production, forming, and joining of metals. The Chemistry and prevention of corrosion

UNITIV   CERAMICMATERIALS   9

Microstructural features of ceramics and glasses - Mechanical properties of ceramics and glasses - Production, forming, and joining of ceramics

UNITV   POLYMERS ANDCOMPOSITES   9

Microstructural features of polymers and composites - Mechanical behaviour of polymers and composites - Production, forming, and joining of polymers and composites.

                                                                            TOTAL   45

TEXT BOOK

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

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	William D Callister Jr	Material Science and Engineering-An Introduction	John Wiley ans Sons Inc., , New York,	2013
2	James F Shackelford	Introduction to materials Science for Engineers	Macmillan Publication Company, New York	2014
3	Charles Kittel	Introduction to Solid State Physics	John Wiley & sons, Singapore.	2007

WEB REFERENCES

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

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

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

UNITI   BASICSOFMECHANISMS   9
Terminology and Definitions–Degree of Freedom – Mobility–Kutzbach criterion–Grashoff's law–Kinematic Inversions of four bar chain and slider crank –Mechanical Advantage–Transmission angle ––Single, double and offset slider mechanisms – Quick return mechanisms – Ratchets and escapements – Indexing Mechanisms – Straight line generators.

UNITII   KINEMATICS   9
Displacement, velocity and acceleration – analysis in simple mechanisms – Graphical Method –velocity and acceleration polygons – Kinematic analysis by Complex Algebra methods–Vector Approach, Instantaneous center – Coriolis Acceleration.

UNITIII   KINEMATICSOFCAM   9
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.

UNITIV   GEARS   9
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.

UNITV   FRICTIONINDRIVES   9
Surface contacts–Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches–Belt and rope drives, Friction aspects in Brakes.

                                                            TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rattan S.S	Theory of Machines	Tata McGraw–Hill, New Delhi	2009
2	Shigley J.E, Uicker J J	Theory of Machines and Mechanisms	McGraw–Hill, Inc, New York	2011

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Thomas Bevan	Theory of Machines	CBS Publishers and Distributors, New Delhi	2011
2	Ghosh A, Mallick A.K	Theory of Mechanisms and Machines	Affiliated East–West Pvt. Ltd., New Delhi	1998
3.	Rao J.S, DukkipatiR.V	Mechanics of Machines	Wiley–Eastern Ltd., New Delhi	2007

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

17BEME405B **INDUSTRIAL ENGINEERING** **3 0 0 3100**

COURSE OBJECTIVES
1. To Understand and apply the principles of science, technology, engineering, and math to solve industry– relatedproblems.
2. To Understand the concepts and terminologies inIndustries
3. To Study and acquire knowledge in creating an industrial designlayout
4. To introduce the methods involved in materialshandling
5. To understand the knowledge in analysis of work processing happening inindustries
6. To equip them with skills to perform work measurement in anindustry

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Understand the concepts and terminologies inIndustries
2. apply their knowledge in creating an industrial designlayout
3. understand the methods involved in materialshandling
4. apply their knowledge in analysis of work processing happening inindustries
5. perform work measurement in anindustry
6. understand the role of human involvement in industrial work systemdesign

UNITI   INTRODUCTION TOINDUSTRIALENGINEERING   9
for layout study – types of layout. Plant location analysis – factors, costs, location decisions – simple problems in single facility location models, network location problems.

UNITII   LAYOUTDESIGN   9
Design cycle – SLP procedure manpower, machinery requirements – computer algorithms – ALDEP, CORELAP, CRAFT

UNITIII   QUANTITATIVE METHODS ANDMATERIALSHANDLING   9
Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing. Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging, Material Handling—Automatic Storage and Retrieval System (ASRS)

UNITIV   OPERATIONS ANALYSIS ANDWORKMEASUREMENT   9
Productivity and living standards, Productivity measurement, work design and Productivity – processplanning – types. Total time for a job or operation, total work content and ineffective time, methods and motions, graphic tools. Stop watch time study – time study through video graphy, Standard data, methods time measurement (MTM), Development of Production Standards, learningeffect.

UNITV   HUMAN FACTORS IN WORKSYSTEM DESIGN   9
Human factors Engineering/Ergonomics, human performance in physical work, anthropometry, design of work station, design of displays and controls.

                                                                TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	O.P. Khanna	Industrial Engineering And Management	Dhanpat rai and Co	2012
2	M.Mahajan	Industrial Engineering and Production Management	Dhanpat rai and Co	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Tompkins .J.A. and J.A. White	Facilities planning	John Wiley	2010
2	James Apple,M.Plant	Material Handling	John Wiley	1977
3	Barnes,R.M	Motion and Time study	John Wiley	1980
4	Bridger R.S	Introduction to Ergonomics	McGraw Hill	2008

WEB REFERENCES

1. http://www.websukat.com/PAOM–plant–layout.htm
2. http://www.du.ac.in/fileadmin/DU/Academics/course_material/EP_07.pdf
3. http://www.scribd.com/doc/60109160/8/Rank–Order–Clustering–Method
4. http://www.zalzala.info/IKMA/LinkedDocuments/GAManufacturing/sld006.htm
5. http://www.wrebv.nl/l6.pdf

COURSE OBJECTIVES
1. To understand the concept of measurements in practical applications.
2. To expose students to linear and angular measurements.
3. To facilitate the understanding of profile measurements in engineering components.
4. To Study and acquire knowledge of measurements in practice using LASER and CMM.
5. To equip students with skills to perform measurements on mechanical and thermal quantities.
6. To equip students with skills to select suitable measuring methods for different applications.

COURSE OUTCOMES
1. Apply the concept of measurements in practical applications.
2. Measure linear and angular measurements.
3. Carry out profile measurements in engineering components.
4. Exhibit measurements in practice using LASER and CMM.
5. Perform measurements on mechanical and thermal quantities.
6. Select suitable measuring methods for different applications

UNITI   CONCEPTOFMEASUREMENT   9
General concept – Generalised measurement systems – units and standards–measuring instruments–sensitivity, readability, range of accuracy, precision–static and dynamic response–repeatability–systematic and random errors – correction, calibration, interchangeability – Basics of Measurement SystemAnalysis.

UNITII   LINEAR ANDANGULARMEASUREMENT   9
Definition of metrology–Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, limit gauges– Comparators: Mechanical, pneumatic and electrical types,applications – Angular measurements: –Sine bar, auto-collimeter, angle Decker.

UNITIII   FORMMEASUREMENT   9
Measurement of screw threads – Thread gauges, floating carriage micrometer–measurement of gears–tooth thickness – constant chord and base tangent method – Eccentricity Measurements – radius measurements–surface finish, straightness, flatness and roundness measurements.

UNITIV   LASER AND ADVANCESINMETROLOGY   9
Precision instruments based on laser–Principles– laser interferometer–application in linear, angular measurements and machine tool metrology - Coordinate measuring machine (CMM) – computer aided inspection - Nano metrology, techniques and applications-TEM,SEM,STM,XRD,AFM.

UNITV   MEASUREMENT OF POWER, FLOW ANDTEMPERATURERELATED   9
          PROPERTIES
Force, torque, strain:–mechanical and electrical type – Flow measurement: Venturi, orifice, rotometer, – Electrical pressure transducers, Temperature: Thermocouples, Resistance temperature detectors, bimetallic strip thermometers, thermister,pyrometry

                                        TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Jain R.K	Engineering Metrology	Khanna Publishers, Delhi	2003
2	Alan S. Morris	The Essence of Measurement	Prentice Hall of India, New Delhi	1997
3	N.V. Raghavendra and L. Krishnamurthy	Engineering Metrology and Measurements	Oxford University press of India	2013

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gupta S.V	Engineering Metrology	Dhanpat rai Publications, New Delhi	2012
2	Tayal A.K	Instrumentation and Mechanical Measurements	Galgotia Publications, New Delhi	2013
3.	Beckwith T.G and N. Lewis Buck N	Mechanical Measurements	Addison Wesley, New york	2007

WEB REFERENCES
1. www.tms.org
2. www.arci.res.in/
3. www.fbh–berlin.com
4. www.lasermetrology.com/
5. www.lasermetrology.com/

COURSE OBJECTIVES
1. To understand the concept of measurements in practical applications.
2. To expose students to linear and angular measurements.
3. To facilitate the understanding of profile measurements in engineering components.
4. To Study and acquire knowledge of measurements in practice using LASER and CMM.
5. To equip students with skills to perform measurements on mechanical and thermal quantities.
6. To equip students with skills to select suitable measuring methods for different applications.

COURSE OUTCOMES
1. Apply the concept of measurements in practical applications.
2. Measure linear and angular measurements.
3. Carry out profile measurements in engineering components.
4. Exhibit measurements in practice using LASER and CMM.
5. Perform measurements on mechanical and thermal quantities.
6. Select suitable measuring methods for different applications

UNITI   BASICS OF MEASUREMENT, DEVICES ANDQUALITY STANDARDS   12

Definition of metrology, economics of measurement, measurement as a comparative process, dimensional properties, terminology and accuracy of measurement, measuring errors, Abbe's Principle, Principle of interferometry- flatness testing, optical interferometer, laser interferometer. Holography and speckle metrology.
General cares and rules in measurement, International standardization, SI units and quantities, BIS- NPL – advantages, ISO 9000 quality standards, QS 9000 standards, Environment standards, metrology room measuring standards room.

UNITII   LINEARMEASUREMENTS   8

Material length standards –line and end measurement – calibration of end bars, datum and reference surfaces, surface plates, gauges – feeler gauges, micrometers, dial test indicator, slip gauges, care of gauge blocks, Comparators- mechanical, electrical, optical and pneumatic, optical projector.

UNITIII   GEOMETRICALMEASUREMENT   9

Angular measurement – plain vernier and optical protractors, sine bar, optical instruments, flatness, parallelism and roundness measurement, need for limit gauge, design of plug gague, Taylor's principle, three basic types of limit gauges, surface texture, reasons for controlling surface texture, parameters used , specification of surface texture, drawing and symbols, Tomilson surface meter.CMM.

UNITIV   METROLOGY OF MACHINEELEMENTS   8

Types of screw threads, terminology, proportions of ISO metric thread, measurement of major, minor and effective diameters. Gear terminology and standard proportions, spur gear measurement, checking of composite errors, base pitch measurement, clean roomenvironment.

UNITV   MACHINE INSTALLATIONANDTESTING   8

Equipment erection, commissioning, testing procedure for lathe, milling, continuous process line. First aid, safety precautions in installation of equipment, protocol for repair and testing, inspection check list.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gupta I C	A text book of Engineering Metrology	Dhanpat Rai publications, New Delhi	2006
2	Jain R K	Mechanical and Industrial Measurements	Khanna Publishers Co Ltd., New Delhi	2014
3	Holmen J P	Experimental Methods for Engineers	Tata McGraw Hill Publications Co Ltd	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Narayana K	Engineering Metrology	Scitech Publication	2006
2	KaniskaBedi	Quality Management	Oxford University Press, Chennai	2007

WEB REFERENCES

1. www.tms.org
2. www.arci.res.in/
3. www.fbh–berlin.com
4. www.lasermetrology.com/
5. www.lasermetrology.com/

**17BEME411   STRENGTH OF MATERIALS AND METALLURGY   0 0 3 2100
LABORATORY**

COURSE OBJECTIVES
1. To understand the the principles of solid mechanics and to determine the behavior of components for applied load.
2. To facilitate the understanding of shear force and bending moment for different types of beams with various load conditions.
3. To give exposure to strain energy, stress distribution & deformation in spring and shaft.
4. To understand the importance of microstructure of hardened and tempered samples.
5. To familiarize the students to understand the effect of various treatments.
6. To Explain about low carbon steel and medium carbon steel.

COURSE OUTCOMES
1. Apply the principles of solid mechanics, to determine the behavior of components for applied load.
2. Compute the shear force and bending moment for different types of beams with various load conditions.
3. Calculate the strain energy, stress distribution & deformation in spring and shaft.
4. Examine the microstructure of hardened and tempered samples.
5. Compare the effect of various treatments.
6. Explain about low carbon steel and medium carbon steel.

LIST OF EXPERIMENTS

1. Tensile test on metals–stress straincharacteristics

2. Cupping test on metal sheets–load deformation characteristics, cupping load, cuppingnumber.

3. Hardness test on metals–Brinell and Rockwell Hardnesstests.

4. Impact test on metals–Charpy, Izod impacttests.

5. Shear test on metals–direct shear strength, single shear, doubleshear.

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 temperedsamples.

9. Tempering – Improvement of Mechanical properties –Comparison for i) Unhardenedspecimen ii) Quenched specimen iii) Quenched and tempered specimen.

10. Study of low carbon steel and medium carbonsteel.

TOTAL   45

17BEME412　　　　**MANUFACTURING TECHNOLOGY LABORATORY**　　　　**0 0 4 2100**

COURSE OBJECTIVES
1. To facilitate the understanding of shaping operation in shaper.
2. To provide practical knowledge on Preparing a flat and contour surface using milling machine.
3. To provide practical knowledge on Preparing holes with higher finish by Drilling / Tapping / Reaming.
4. To facilitate the understanding of surface and cylindrical grinding operations for surface finish.
5. To introduce single and multi point cutting tools.
6. To impart knowledge on the operations in Capstan and Turret Lathe.

COURSE OUTCOMES
1. Perform shaping operation in shaper.
2. Prepare a flat and contour surface using milling machine.
3. Prepare holes with higher finish by Drilling / Tapping / Reaming.
4. Perform surface and cylindrical grinding operations for surface finish.
5. Prepare the single and multi point cutting tools.
6. Perform operations in Capstan and Turret Lathe.

EXERCISES

1. Exercises inshaping.
2. Exercises inMilling.
3. Exercises inslotting.
4. Exercises in Drilling / Tapping /Reaming.
5. Exercises in Surface grinding and cylindrical grindingprocess.
6. Exercises in Tool grinding – single point and multi pointtools.
7. Exercises in Capstan and TurretLathe.

　　　　　　　　　　　　　　　　　　　　　TOTAL　　　　**45**

17BEME413　　　　　　**COURSE ORIENTEDPROJECTII**　　　　**0 0 2 1100**

17BEME451   PRODUCTION DRAWING ANDCOSTESTIMATION   1 0 0 -100

COURSE OBJECTIVES
1. To gain knowledge in sequence of process planning and cost estimation of variousproducts.
2. To introduce the concepts of dimensional and toleranceanalysis
3. To expose students to manufacturingdrawings
4. To equip them with skills to apply their knowledge in re-dimensioning and tolerancecharting
5. To understand the process chart for a givencomponent
6. To Estimate the cost of a givencomponent

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Apply the various standards and conventions used in a drawingsheet
2. Perform dimensional and toleranceanalysis
3. Understand the manufacturingdrawings
4. Apply their knowledge in re-dimensioning and tolerancecharting
5. Prepare process chart for a givencomponent
6. Estimate the cost of a givencomponent

UNITI   **5**
        Geometric Dimensioning and Representation - Tolerancing, Tolerancing of form, orientation, location and run-outs, Datums and Datum Systems.

UNITII   **5**
        Surface texture indication on drawing. Welds - Symbolic representing ofdrawings. Preparation of process - Chart for a given component.

UNITIII   **5**
        Cost Estimation of setting time and machining time - estimation of material cost, labour cost and overhead cost based on supplied data.

TOTAL   15

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Siddeshwar and Kanniah	Machine Drawing	Tata McGraw Hill	2001
2	Gopalakrishna, K.R	Machine Drawing, 16th Edition	Subhas Stores	2002
3	Wade, O	Tolerance Control in design and manufacturing	Industrial Press	1972

17BEME501	HEATPOWERENGINEERING	3 0 0 3100

COURSE OBJECTIVES
1. To make the students conversant on performance of various gas power cycles and IC engines.
2. To make the student acquire sound knowledge on working principles of different types of steam generators, mountings and accessories.
3. To understand the importance of shape of blades, work output of typical turbine stages with its velocity diagram.
4. To provide knowledge on difference in working principle and performance of reciprocating and rotary compressors.
5. To expose students to Perform the cooling and heating load calculations of refrigeration
6. To expose students to Perform the cooling and heating load calculations of air conditioning.

COURSE OUTCOMES
1. Analyze the performance of various gas power cycles and IC engines.
2. Understand the working principles of different types of steam generators, mountings and accessories.
3. Understand the shape of blades, work output of typical turbine stages with its velocity diagram.
4. Show the difference in working principle and performance of reciprocating and rotary compressors.
5. Perform the cooling and heating load calculations for a specified application.
6. Apply the basic thermodynamic concepts in various engineering applications.

UNITI   GAS POWER CYCLES ANDICENGINES   9
Otto, Diesel, Dual, Brayton cycles – Calculation of mean effective pressure and air standard efficiency – actual and theoretical PV and TS diagrams of two stroke and four stroke engines–valve timing diagram and port timing diagram – calculation of engine performance, heat balance sheet, retardation – Morse test.

UNITII   BOILER AND STEAMPOWERCYCLES   9
Generation of steam, Boiler–Classification, fire tube boiler, water tube boiler, comparison, boiler mountings and accessories, performance of steam boilers – dryness fraction, properties of steam, T–S diagram, Mollier diagram, steam tables, Rankine Cycle – incomplete evaporation – superheated steam –modified cycle.

UNITIII   STEAM NOZZLES ANDSTEAM TURBINES   9
Steam nozzles – flow through steam nozzles, effect of friction, critical pressure ratio, super saturated flow – Steam turbines– impulse and reaction turbine, compounding, velocity diagram, condition for maximum efficiency – multi stage turbines, cycles with reheating and regenerating heating – reheat factor, degree of reaction - governing of turbines.

UNITIV   AIRCOMPRESSORS   9
Classifications of compressors – Reciprocating air compressor – performance characteristics, effect of clearance volume, free air delivery and displacement, intercooler, after cooler – Rotary compressor – vane type, centrifugal and axial, flow performancecharacteristics.

UNITV   REFRIGERATION ANDAIRCONDITIONING   9
Fundamentals of refrigeration – COP – Vapour compression refrigeration system – cycle, p–h chart, Vapour absorption system – comparison, properties of refrigerants. Fundamentals of air conditioning system, cycle, controls, air handling and distribution, simple cooling and heat load estimation

                                                                TOTAL   45

(Permitted to use standard thermodynamic table, Mollier diagram, Psychometric chart and Refrigeration property table in the examination)

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rajput R.K	Thermal Engineering, Sixth edition	Laxmi Publications, New Delhi	2015
2	Arora C.P	Refrigeration and Air conditioning	Tata McGraw–Hill, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kothandaraman C.P, and DomkundwarA.V	A course in Thermal Engineering, Fifth Edition	Dhanpat Rai and Sons, Delhi	2006
2	Ganesan V	Internal Combustion Engines	Tata McGraw–Hill, New Delhi	2012
3.	Yunus A Cengel	Thermodynamics' An Engineering Approach	Tata McGraw Hill, New Delhi	2015

WEB REFERENCES
1. www.kruse–ltc.com
2. www.grc.nasa.gov
3. www.poweronsite.org
4. www.machinerylubrication.com
5. www.tpub.com

COURSE OBJECTIVES
1. To understand the various types of stresses induced in different machine members.
2. To Study and acquire knowledge on design shaft and couplings for effective transmission of power.
3. To study the features of welded joints and fasteners required for various industrial applications.
4. To give exposure to design springs and flywheels for various engineering applications.
5. To understand the importance design bearings and levers for engineering applications.
6. To make the students conversant to implement design procedure for designing a machine.

COURSE OUTCOMES
1. Determine various types of stresses induced in different machine members.
2. Design shaft and couplings for effective transmission of power.
3. Select the type of welded joints and fasteners required for various industrial applications.
4. Design springs and flywheels for various engineering applications.
5. Design bearings and levers for engineering applications.
6. Implement design procedure for designing a machine.

**UNITI   STEADY STRESSES AND VARIABLE STRESSESINMACHINE   12
              MEMBERS**

Introduction to the design process – factors influencing machine design, selection of materials based on mechanical properties – Factor of safety. Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame – theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

UNITII   DESIGN OF SHAFTSANDCOUPLINGS   12

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and keyways – Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings – design of knuckle joints.

UNITIII   DESIGN OF FASTENERS ANDWELDEDJOINTS   12

Threaded fasteners – Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures – theory of bonded joints.

UNITIV   DESIGN OF SPRINGS ANDFLYWHEEL   12

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs – Belleville springs – Design of flywheels involving stresses in rim and arm.

UNITV   DESIGN OF BEARINGSANDLEVERS   12

Selection of bearings – sliding contact and rolling contact types – Cubic mean load – Selection of journal bearings – McKees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of Levers.

                                                          TOTAL   60

(Permitted to use PSG design data book in the examination)

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Juvinall R.C and Marshek K.M	Fundamentals of Machine Component Design Third Edition	John Wiley and Sons, New Delhi	2011
2	Bhandari V.B	Design of Machine Elements	Tata McGraw–Hill Book Co, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Norton R.L	Design of Machinery	Tata McGraw–Hill Book Co., New Delhi	2011
2	Orthwein W	Machine Component Design	Jaico Publishing Co., New Delhi	2003
3.	Ugural A.C	Mechanical Design – An Integral Approach	McGraw–Hill Book Co., New York	2004
4	Spotts M.F, ShoupT.E	Design and Machine Elements	Pearson Education, New Delhi	2004

WEB REFERENCES

1. www.roymech.co.uk
2. www.ncbi.nlm.nih.gov
3. www.engineersedge.com
4. www.bearings.machinedesign.com
5. www.efunda.com

COURSE OBJECTIVES

1. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and cam mechanisms for specified outputmotions.
2. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machinecomponents.
3. To understand the force-motion relationship in components subjected to external forces and analysis of standardmechanisms.
4. To understand the undesirable effects of unbalances resulting from prescribed motions inmechanism.
5. To expose students to vibration phenomenon and its types along with the vibrationterminologies.
6. To understand the effect of Dynamics of undesirablevibrations.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Identify the type and mechanism and will be able to perform velocity and accelerationanalysis
2. Classify the types of friction and understand the friction applications used in screw threads, clutches, brakes.
3. Specify the gear terminology and to select appropriate gear trains for engineeringapplications.
4. Perform force analysis of reciprocating engine and balancing of rotating & reciprocatingmasses.
5. Describe the vibration phenomenon and its types along with the vibrationterminologies.
6. Analyze the systems subjected tovibration

UNITI   FORCEANALYSIS   9

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.

UNITII   BALANCING   9

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

UNITIII   FREEVIBRATION   9

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 – Damping Types of Damping – Damped vibration, critical speeds of simple shaft.

UNITIV   FORCED VIBRATION ANDTORSIONALVIBRATION   9

Response to periodic forcing – Harmonic Forcing – Forcing caused by unbalance – Support motion – Force transmissibility and amplitude transmissibility – Vibration isolation.
Torsional systems; Natural frequency of free torsional vibrations, Natural frequency of two and three rotor systems.

UNITV   MECHANISMSFORCONTROL   9

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

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rattan S.S	Theory of Machines	Tata McGraw–Hill Publishing Company Ltd., New Delhi	2014
2	Shigley J.E, UickerJ.J	Theory of Machines and Mechanisms	McGraw–Hill, New York	2011

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rao J.S., DukkipatiR.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	CBS Publishers and Distributors, New Delhi	2011

WEB REFERENCES

1. http://freevideolectures.com/Course/2364/Dynamics–of–Machines
2. http://en.wikipedia.org/wiki/Balancing_of_rotating_masses
3. http://www.efunda.com/formulae/vibrations/sdof_free_damped.cfm
4. http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html

COURSE OBJECTIVES

1. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and cam mechanisms for specified outputmotions.
2. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machinecomponents.
3. To understand the force-motion relationship in components subjected to external forces and analysis of standardmechanisms.
4. To understand the undesirable effects of unbalances resulting from prescribed motions inmechanism.
5. To expose students to vibration phenomenon and its types along with the vibrationterminologies.
6. To understand the effect of Dynamics of undesirablevibrations.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Identify the type and mechanism and will be able to perform velocity and accelerationanalysis
2. Classify the types of friction and understand the friction applications used in screw threads, clutches, brakes.
3. Specify the gear terminology and to select appropriate gear trains for engineeringapplications.
4. Perform force analysis of reciprocating engine and balancing of rotating & reciprocatingmasses.
5. Describe the vibration phenomenon and its types along with the vibrationterminologies.
6. Analyze the systems subjected tovibration

UNITI   KINEMATICANALYSIS   9
Introduction- General concepts, Introduction of Simple mechanism, Different types of Kinematics pair, Grublers rule for degree of freedom, Grashof's Criterion for mobility determination.
Kinematic Analysis- Concepts of vectorial analysis. Velocity and Acceleration Analysis of planar mechanisms

UNITII   CAMS ANDGEARS   9
Cams- Classifications – Displacement diagrams–parabolic, Simple harmonic and Cycloidal motions – Layout of cam profiles – Knife and Roller followers.
Gears- Geometry of tooth profiles, Law of gearing, Involute profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains

UNITIII   DYNAMICANALYSIS   9
Dynamic Analysis of Slider-crank mechanisms, turning moment computations.
Balancing- Static and Dynamic balancing Balancing of revolving & reciprocating masses in single and multi-cylinder engines.

UNITIV   VIBRATION   9
Vibration analysis of SDOF systems, Natural, damped forced vibrations, Based-excited vibrations, transmissibility ratio.

UNITV   MECHANISMSFORCONTROL   9
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

                                                        TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rattan S.S	Theory of Machines	Tata McGraw–Hill Publishing Company Ltd., New Delhi	2014
2	Shigley J.E, UickerJ.J	Theory of Machines and Mechanisms	McGraw–Hill, New York	2011

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rao J.S., DukkipatiR.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	CBS Publishers and Distributors, New Delhi	2011

WEB REFERENCES

1. http://freevideolectures.com/Course/2364/Dynamics–of–Machines
2. http://en.wikipedia.org/wiki/Balancing_of_rotating_masses
3. http://www.efunda.com/formulae/vibrations/sdof_free_damped.cfm
4. http://www.roymech.co.uk/Useful_Tables/Vibrations/Free_Vibrations.html

17BEME5E --	PROFESSIONALELECTIVEI	3 0 0 3100

17BEME5E --	PROFESSIONALELECTIVEII	3 0 0 3100

17BEME511	SCIENTIFICCOMPUTINGLABORATORY	2 0 2 3100

COURSE OBJECTIVES
1. To introduce the scientific computing, covering some important aspects of solving algebraic equations, IVP,BVP.
2. To implement the methods using the spread sheet inExcel.
3. To make students familiar with the concepts of programming and the get them accustomed with high-level languages like Matlab, Mathematica, etc.
4. To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration
5. To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and differential equations and simulation.
6. To make students to get knowledge about real-time problem-solving skill.

COURSE OUTCOMES

1. Apply numerical methods to find our solution of algebraic equations using different methods.
2. Understand the different conditions, and numerical solution of system of algebraic equations.
3. Apply various interpolation methods and finite difference concepts.
4. Can apply numerical differentiation and integration whenever and wherever routine methods are not applicable.
5. Work numerically on the ordinary differential equations using different methods through the theory of finite differences.
6. Work numerically on the partial differential equations using different methods through the theory of finite differences.

LIST OF EXPERIMENTS

1. Finding solution of Transcendentalequation
   i) Newton – RaphsonMethod
   ii) Bisectionmethod
   iii) Iterative method by reducing the equation to the form $x=f(x)$

2. Finding the dominant eigenvalue and eigenvector by powermethod

3. Numericalintegration
   i) Gauss 2 point and 3 pointformulae
   ii) Trapezoidal method
   iii) Simpson's 1/3rule

4. Solution of initial value problems governed byODE
   i) Runge - Kutta 4th ordermethod
   ii) Modified Euler'smethod
   iii) Milne'smethod
   iv) Adam – Bashforthmethod

5. Solution of BVP governed byPDE
   i) LaplaceEquation
   ii) One – dimensional heatequation
      a) Explicit method : Bender – Schmidt'smethod
      b) Implicit method : Crank - Nicolson'smethod
   iii) One dimensional wave equation Implicitmethod

TOTAL   60

REFERENCES

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

17BEME512   **DYNAMICS AND METROLOGY LABORATORY**   **0 0 4 2100**

COURSE OBJECTIVES
1. To Understand the working of various governors.
2. To introduce jump speed and profile of the cam
3. To understand the importance of moment of inertia by oscillation method for connecting rod and flywheel.
4. To introduce the concepts to Characterize and calibrate measuring devices.
5. To expose students to measuring taper angle straightness, flatness, surface finfish and thread parameters.
6. To explain the limits of dimensional tolerances using comparators.

COURSE OUTCOMES
1. Understand the working of various governors.
2. Determine of jump speed and profile of the cam
3. Determine moment of inertia by oscillation method for connecting rod and flywheel.
4. Characterize and calibrate measuring devices.
5. Measure taper angle straightness, flatness, surface finfish and thread parameters.
6. Examine the limits of dimensional tolerances using comparators.

LIST OF EXPERIMENTS

DYNAMICS

1. Governors–Determinationofsensitivity,effort,etc.forWatt,Porter,Proell,andspring-controlled Governors
2. Cam – Determination of jump speed and profile of thecam.
3. Motorized Gyroscope–Verification of laws –Determination of gyroscopiccouple.
4. Whirling of shaft–Determination of critical speed of shaft with concentratedloads.
5. Balancing of rotating and reciprocatingmasses.
6. Determination of moment of inertia by oscillation method for connecting rod andflywheel.
7. Vibrating system – spring mass system – Determination of damping co–efficient of single degree of freedomsystem
8. Determination of torsional frequencies for compound pendulum and flywheel system withlumped moment ofinertia.
9. Transverse vibration –free– Beam. Determination of natural frequency and deflection ofbeam.
10. Strain gauge measurementsystem.

METROLOGY

1. Calibration of Vernier / Micrometer / Dialgauge
2. Checking dimensions of part using slipgauges
3. Measurement of gear tooth dimensions – addendum, dedendum, pitch circle diameter and tooththickness
4. Measurement of taper angle using sine bar / tool makers microscope
5. Measurement of straightness andflatness
6. Measurement of threadparameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic /Electrical)
8. Surface finish measurement

                                                   TOTAL   **45**

17BEME513   **THERMAL ENGINEERINGLABORATORYI**   **0 0 3 2100**

COURSE OBJECTIVES
1. To impart knowledge on valve timing diagram and port timing diagram for single cylinder four stroke diesel engine and two stroke petrol engines.
2. To understand the importance of mechanical efficiency of four stroke SI engine by Morse test.
3. To provide an overview of performance of four stroke single cylinder CI engine.
4. To provide an overview of performance of steam generator and steam turbines.
5. *To expose students to the flash and fire point of various fuel*
6. *To expose students to the flash and fire point of various lubricants*

COURSE OUTCOMES
1. Sketch the valve timing diagram for four stroke diesel engine andpetrol engines.
2. Sketch the port timing diagramfor single cylinder two stroke diesel engine andpetrol engines.
3. Calculate the mechanical efficiency of four stroke SI engine by Morse test.
4. Evaluate the performance of four stroke single cylinder CI engine.
5. Evaluate the performance of steam generator and steam turbines.
6. Measure the flash and fire point of various fuel/lubricants.

LIST OF EXPERIMENTS
1. Valve Timing and Port TimingDiagrams.
2. Performance Test on 4–stroke DieselEngine.
3. Heat Balance Test on 4–stroke DieselEngine.
4. Load test on 4–stroke DieselEngine.
5. Morse Test on multicylinder PetrolEngine.
6. Retardation Test to find Frictional Power of a DieselEngine.
7. Determination of Viscosity – Red WoodViscometer.
8. Determination of Flash Point and FirePoint.
9. Study of Steam Generators andTurbines.
10. Performance and energy balance test on a steamgenerator

TOTAL   **45**

17BEME514   **COURSE ORIENTEDPROJECTIII**   **0 0 2 1100**

COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

Students will undergo industrial training for four 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.

17BEME552   GEOMETRICAL DIMENSIONINGANDTOLERANCE   1 0 0 -100

COURSE OBJECTIVES

1. To understand the concepts of geometrical dimensioning andTolerancing
2. To study the physical importance of them in industrial point ofview
3. To know the various types of Tolerancing, its measurement anddesign.
4. To translate geometric callouts into plain English with one meaning.
5. To explain the major rules found in ASME Y14.5-2009
6. To understand the hierarchy of geometric tolerancing.

COURSE OUTCOMES

1. Ability to learn and apply geometric dimensioning and tolerance standards to communicate designintent
2. Ability to Learn how the knowledge of certain processes can affect part design anddocumentation
3. Gain added insight on working in a team designenvironment.
4. Translate geometric callouts into plain English with one meaning.
5. Explain the major rules found in ASME Y14.5-2009
6. Understand the hierarchy of geometric tolerancing

UNITI   INTRODUCTION TO GDANDT   5

Introduction to Geometric dimensioning and Tolerancing – working of geometric system – Terms and definitions – Common symbols and Terminology – Fundamental Rules (Drawing)– Feature definition – With Size and Without Size – Material Condition (Maximum, Least, Regard of Material Condition)– Limit Tolerancing – Dimension Origin –Limits of Size, Rule 1 or Envelope Principle – Go– No Go Gauges.

UNITII   FORM ANDORIENTATIONTOLERANCE   5

and design considerations – Flatness and Circularity measurement concepts – Orientation tolerance specification and application design.

UNITIII   POSITION ANDRUNOUTTOLERANCE   5

Profile of surface and line tolerance design and application – Location tolerance, Position, applied and material condition consideration – Coaxial controls and design – Concentricity, Symmetry – Measurement and application – Design considerations – Position, Composite tolerance concept, design and Measurement – Runout, Total Runout tolerances – Measurement and considerations.

TOTAL   15

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Siddeshwar and Kanniah	Machine Drawing	Tata McGraw Hill	2001
2	Gopalakrishna, K.R	Machine Drawing	, Subhas Stores	2002
3.	Wade. O	Tolerance Control in design and manufacturing	Industrial Press	1972

WEB REFERENCE

1. IS :10714,10715,10716,10717,11669,10719,813,919,2709,8000 pt 1 to 10721,11158 andAWS/ISO

17BEME601   **OPERATIONSRESEARCH**   **3 1 0 4100**

COURSE OBJECTIVES
1. To Formulate and solve engineering and managerial situations as LPP.
2. To understand theEngineering and Managerial situations in Transportation.
3. To Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
4. To give exposure to inventory in industry.
5. To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
6. To provide an overview of various tools in various sections of industries like marketing, material handling etc.

COURSE OUTCOMES
At the end of the course, student will be able to understand the
1. Formulate and solve engineering and managerial situations as LPP.
2. Solve Engineering and Managerial situations in Transportation.
3. Give Engineering and Managerial solutions in Assignment and scheduling problems.
4. Manage inventory in industry.
5. Select better sequence to perform operation among various alternatives.
6. Apply the various tools in various sections of industries like marketing, material handling etc.

UNITI   INTRODUCTION TOOPERATIONS RESEARCH   12
Operations research and decision–making – types of mathematical models and constructing the model – Role of computers in operations research –Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, graphical method, simplex method – The Big –M method – the two–phase method.

UNITII   TRANSPORTATIONPROBLEMS   12
Least cost method, North west corner rule, Vogel's approximation method, modified distribution method, optimization models, unbalance and degeneracy in transportation model.

UNITIII   ASSIGNMENT MODELSANDSCHEDULING   12
Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case in assignment problems, traveling salesman problem. Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing two jobs through 'm' machines, processing n jobs through m machines.

UNITIV   INVENTORY CONTROL ANDQUEUINGTHEORY   12
Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi item deterministic model.
Queuing Models: Queues – Notation of queues, performance measures, The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns.

UNITV   PROJECT MANAGEMENT, GAME THEORY,REPLACEMENTMODELS   12
Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing – Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

                                      TOTAL   60

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kanti Swarup, Gupta P.K and Manmohan	Operations Research	Sultan Chand and Sons, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Viswanathan N and Narahari Y	Performance Modeling of Automated Manufacturing Systems	Prentice Hall Inc, Newyork	2000
2	Prem kumar Gupta and Hira D.S	Operation Research	S Chand and Company Limited, New Delhi	2015

WEB REFERENCES

1. http://www.scienceofbetter.org/what/index.htm
2. http://www.informs.org/Pubs/OR
3. http://www.me.utexas.edu/~jensen/ORMM/models/unit/network/subunits/special_cases/transportation.html
4. http://www.projectmanagement.com/

17BEME602   **DESIGN OF TRANSMISSION SYSTEM**   **3 0 0 3100**

COURSE OBJECTIVES
1. To Study and acquire knowledge on design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. To Study and acquire knowledge on design spurs and parallel axis helical gears.
3. To give exposure to dimensions for bevel and worm gears.
4. To provide an overview ofdesign procedures of gear boxes for industrial applications.
5. To provide an overview ofclutches and brakes for engineering applications.
6. To make the student acquire sound knowledgeofmechanical system

COURSE OUTCOMES

Upon completion of this course, the students will able to
1. Design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. Design spurs and parallel axis helical gears.
3. Estimate the dimensions for bevel and worm gears.
4. Practice the design procedures of gear boxes for industrial applications.
5. Design clutches and brakes for engineering applications.
6. Design a mechanical system

UNITI   DESIGN OF TRANSMISSION SYSTEMS FORFLEXIBLEELEMENTS   9
Design of V belts and pulleys – Selection of Flat belts and pulleys – Wire ropes and pulleys – Selection of Transmission chains and Sprockets – Design of sprockets.

UNITII   DESIGN OF SPUR ANDHELICALGEARS   9
Gear Terminology – 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 and wear considerations – Parallel axis Helical Gears – Pressure angle in the normal and transverse plane– Equivalent number of teeth–forces and stresses – Estimating the size of the helical gears.

UNITIII   DESIGN OF BEVEL ANDWORMGEARS   9
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits– terminology – Thermal capacity, materials–forces and stresses, efficiency, estimating the size of the worm gear pair – Cross helical: Terminology–helix angles–Estimating the size of the pair of cross helical gears.

UNITIV   DESIGN OFGEARBOXES   9
Geometric progression – Standard step ratio – Ray diagram, kinematics layout –Design of sliding mesh gear box –Constant mesh gear box. – Design of multi speed gear box.

UNITV   DESIGN OF CLUTCHESANDBRAKES   9
Design of plate clutches –axial clutches–cone clutches–internal expanding rim clutches–internal and external shoe brakes.

                                                                      TOTAL   45

(Permitted to use PSG design data book in the examination)

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	JuvinallR. C, MarshekK.M	Fundamentals of Machine component Design	John Wiley and Sons., London	2011
2	Bhandari, V.B	Design of Machine Elements	Tata McGraw–Hill Publishing Company Ltd, New York	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Maitra G.M., Prasad L.V	Hand book of Mechanical Design	Tata McGraw–Hill, New Delhi	2009
2	Shigley J.E, Mischke C.R	Mechanical Engineering Design	McGraw–Hill International Editions, New Delhi	2014
3	Prabhu. T.J	Design of Transmission Elements	Mani Offset, Chennai	2002

WEB REFERENCES
1. http://en.wikipedia.org/wiki/Gear
2. http://www.physicsforums.com/showthread.php?t=292163
3. http://www.seminarprojects.com/Thread–design–and–fabrication–of–gearbox–full–report
4. http://www.cs.cmu.edu/~rapidproto/mechanisms/chpt6.htm

COURSE OBJECTIVES
1. To Study and acquire knowledge on heat transfer for conduction.
2. To introduce the concepts of heat transfer coefficients for natural and forced convection for different fluid flows.
3. To understand the performance of heat exchanger.
4. To study the features of radiation heat transfer between the surfaces.
5. To give exposure to mass transfer.
6. To make the students conversant to solve complex problems where heat and mass transfer takes place.

COURSE OUTCOMES
1. Determine the rate of heat transfer for conduction.
2. Evaluate heat transfer coefficients for natural and forced convection for different fluid flows.
3. Analyze performance of heat exchanger.
4. Estimate the radiation heat transfer between the surfaces.
5. Calculate the coefficient of mass transfer.
6. Solve complex problems where heat and mass transfer takes place.

UNITI   CONDUCTION   12
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 HeislersChart.

UNITII   CONVECTION   12
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 andSpheres.

UNITIII   PHASE CHANGE HEAT TRANSFER ANDHEATEXCHANGERS   12
Nusselts theory of condensation–pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors.

UNITIV   RADIATION   12
Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation - Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

UNITV   MASS TRANSFER   12
Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations

                                                                    TOTAL   60

(Permitted to use standard Heat and Mass Transfer Table in the examination)

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sachdeva R.C	Fundamentals of Engineering Heat and Mass Transfer	New Age International, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Frank P. Incropera and David P. DeWitt	Fundamentals of Heat and Mass Transfer	John Wiley and Sons, New Delhi	2011
2	OzisikM.N	Heat Transfer	McGraw–Hill Book Co, New Delhi	1994
3	KothandaramanC.P	Fundamentals of Heat and Mass Transfer	New Age International, New Delhi	2012

WEB REFERENCES
1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IISc–BANG/Heat%20and%20Mass%20Transfer/New_index1.html
2. http://www.learnerstv.com/Free–Engineering–Video–lectures–ltv084–Page1.htm
3. http://en.wikipedia.org/wiki/Heat_transfer

COURSE OBJECTIVES
1. To enable students to understand the fundamental economic concepts applicable to engineering
2. To learn the techniques of incorporating inflation factor in economic decision making.
3. To Understand the measures of national income, the functions of banks and concepts of globalization
4. To Apply the concepts of financial management for project appraisal
5. To Understand accounting systems and analyze financial statements using ratio analysis
6. To Understand Financial planning, economic basis for replacement.

COURSE OUTCOMES
1. Evaluate the economic theories, cost concepts and pricing policies.
2. Understand the market structures and integration concepts
3. Understand the measures of national income, the functions of banks and concepts of globalization
4. Apply the concepts of financial management for project appraisal
5. Understand accounting systems and analyze financial statements using ratio analysis
6. Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems

UNIT1   FUNDAMENTALS OFENGINEERINGECONOMICS   9
Introduction to Engineering Economics – Definition, Scope and Significance – Demand and supply analysis – Definition – Law of Demand – Elasticity of Demand – Demand Forecasting – Supply – Law of supply – Elasticity of Supply.

UNITII   COMMERCIALBANKING   9
Law of contracts, negotiable instruments, its types and regulations there on – New Industrial Policy – MSME sector – Development financial institutions and their relevance – Export Promotion - DICGC, ECGCI, EXIM Bank - Import and export concepts - Letter of credit, forward contracts / hedging.

UNITIII   CAPITALMARKET   9
Stock Exchanges – Functions – Listing of Companies – Role of SEBI – Capital Market Reforms. Money and banking - Money – Functions –Inflation and deflation – Commercial Bank and its functions – Central bank and its functions.

UNITIV   FINANCIALCONCEPTS   9
Introduction, scope and objectives of basic financial concepts – time value of money – Interest - simple & compound interest, annuity and effective rate of interests. Appraisal of project for profitability, internal rate of return – payback period – net present value. NPV comparison – cost benefit analysis. Sources of finance – internal and external.

UNITV   COST ANALYSIS AND BREAKEVENANALYSIS   9
Cost analysis - Basic cost concepts – Financial accounting, account posting rules, Trial balance, Profit and loss account and Balance sheet aspects – 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 ofBEA.

           TOTAL   **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	RamachandraAryasri V. V.RamanaMurthy	Engineering Economics & Financial Accounting	Tata McGraw Hill,–,New Delhi	2007
2	Varshney R. L., and K.L Maheshwari	Managerial Economics	Sultan Chand & Sons, New Delhi	2001

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	M.L.Jhingan	Principles of Economics	Konark Publications	2010
2	Prasanna Chandra	Fundamentals of Financial Management	Tata McGraw Hill, New Delhi.	2007
3	D.M.Mithani	Money, Banking, International Trade & Public Finance	Himalaya Publishing House	2004

WEB REFERENCES

1. http://economictimes.indiatimes.com
2. http://www.economist.com/
3. http://www.managementstudyguide.com/financial-management.htm

17BEME6E - -	**PROFESSIONAL ELECTIVE III**	**3 0 0 3100**

17BEME6E --	**PROFESSIONALELECTIVEIV**	**3 0 0 3100**

17BEME611	**COMPUTER AIDED MODELINGANDSIMULATION LABORATORY**	**0 0 3 2100**

COURSE OBJECTIVES
1. To gain practical experience in handling 2D drafting and 3D modeling softwaresystems.
2. To impart training on SOLID WORKS for modelling
3. To provide knowledge on assembly ofcomponents
4. To facilitate the understanding of manufacturing drawings from the modelscreated
5. To understand the importanceof MAT Lab for simulating different systems
6. To acquaint the student with the conceptsof mat lab for performing various mathematical operations

COURSE OUTCOMES

Upon completion of this course, the students can able to
1. use computer and CAD software's for modeling of mechanicalcomponents
2. use various options in SolidWorks for modeling of givencomponents
3. create assembly ofcomponents
4. prepare manufacturing drawings from the modelscreated
5. Use MAT Lab for simulating different systems like hydraulic and pneumaticcircuits
6. Use mat lab for performing various mathematicaloperations

COMPUTER AIDED DESIGN

1. 3D modeling of various machine elements using various options like protrusion, cut,sweep, draft, loft, blend,rib.

2. Assembly – creating assembly from parts – assemblyconstraints

3. Conversion of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning.

4. Introduction to SurfaceModeling.

5. Introduction to File Import, Export – DXF, IGES, STL,STEP

Note: Any one of the 3D MODELING software's like SOLIDWORKS, CREO, CATIA, NX Software, AutoCADetc.

COMPUTER AIDED SIMULATION

1. Simulation of Air conditioning system with condenser temperature and evaporatortemperatures as input to get COP usingSoftware

2. Simulation of Hydraulic / Pneumatic cylinder usingSoftware

3. Simulation of cam and follower mechanism usingSoftware

4. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and twovariables

5. Use of MATLAB to solve simple problems invibration

TOTAL   **45**

17BEME612   **THERMAL ENGINEERING LABORATORY II**   **0 0 3 2100**

COURSE OBJECTIVES
1. To impart knowledge on thermal conductivity of various engineering materials.
2. To acquaint the student with the concepts of heat transfer rate in free and forced convection environment.
3. To Study and acquire knowledge of grey surface.
4. To study the features of Stefan–Boltzmann constant.
5. To provide an overview of the effectiveness of parallel and counter flow heat exchanger.
6. To provide an overview of COP of refrigeration and air conditioning system and performance of air compressor and fluidized bed cooling tower

COURSE OUTCOMES
1. Conduct a test to find thermal conductivity of various engineering materials.
2. Measure heat transfer rate in free and forced convection environment.
3. Measure emissivity of grey surface.
4. Determine Stefan–Boltzmann constant.
5. Measure the effectiveness of parallel and counter flow heat exchanger.
6. Measure COP of refrigeration and air conditioning system and performance of air compressor and fluidized bed cooling tower.

LIST OF EXPERIMENTS
HEAT TRANSFER

1. Heat transfer through a compositewall
2. Thermal conductivity measurement by guarded platemethod
3. Natural convection heat transfer from a verticalcylinder
4. Heat transfer from pin–fin (natural and forced convectionmodes)
5. Effectiveness of Parallel/counter flow heatexchanger
6. Determination of Stefan–Boltzmannconstant
7. Determination of emissivity of a greysurface

REFRIGERATION AND AIR CONDITIONING

1. Performance test on single/two stage reciprocating aircompressor.
2. Determination of COP of a refrigerationsystem
3. Experiments on air–conditioningsystem

TOTAL   45

17BEME613   **COURSE ORIENTEDPROJECTIV**   **0 0 2 1100**

17BEME651   **MINIPROJECT**   **0 0 1 -100**

COURSE OBJECTIVE
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSEOUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

17BEME652   **TECHNICALPRESENTATION**   **1 0 0 -100**

COURSE OBJECTIVES

1. To equip the students with effective technicalpresentation
2. To understand the barriers and bridges tocommunication
3. To improve the public speaking capabilities, body language andposture.
4. To improve the literature survey skill.
5. To develop presentation skill using power point presentation
6. To improve skill to face viva voce examination.

COURSE OUTCOMES
1. Develop the ability to fabrication skill.
2. Ability to make literature review till the successful solution.
3. Ability to identify specific problems.
4. Gain the knowledge about data collection and conducting experiments.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

TOTAL   **15**

17BECC701   PROFESSIONAL ETHICS, PRINCIPLESOFMANAGEMENT   3 0 0 3100
AND ENTREPRENEURSHIPDEVELOPMENT

COURSE OBJECTIVE
1. To understand objectives, Strategies, Policies and Plan.
2. To introduce pans by directing and controlling.
3. To Understand the need of Engineering Ethics.
4. To Understand the forces that shape culture.
5. To develop the entrepreneurial skills.
6. To make the students conversant to execute an engineering plan with ethics.

COURSE OUTCOMES
1. Prepare objectives, Strategies, Policies and Plan.
2. Execute plans by directing and controlling.
3. Understand the need of Engineering Ethics.
4. Understand the forces that shape culture.
5. Show the entrepreneurial skills.
6. Execute an engineering plan with ethics.

UNITI   HISTORICAL DEVELOPMENT,PLANNING,ORGANISING   9
Definition of Management – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies and Planning Premises– Forecasting – Decision–making – Formal and informal organization – Organization Chart –.

UNITII   DIRECTINGANDCONTROLLING   9
Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment –Process of Communication – System and process of Controlling – Requirements for effective control – Control of Overall Performance – Direct and Preventive Control – Reporting

UNITIII   ENGINEERINGETHICS   9
Senses of 'Engineering Ethics' – variety of moral issued – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – Models of ProfessionalRoles – theories about right action – Self–interest – customs and religion – uses of ethical theories.

UNITIV   FACTORSOFCHANGES   9
Forces that shape culture, social control – Meaning, Agencies, Institution, Customs, Values, Folkways, Norms and Laws. Social changes – Meaning and nature – Theories.

UNITV   ENTREPRENEURSHIPANDMOTIVATION   9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth– Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need,Objectives.

                                                                          TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Harold Kooritz and Heinz Weihrich	Essentials of Management	Tata McGraw Hill, New Delhi	2010
2	Khanka S.S	Entrepreneurial Development	S.Chand and Co. Ltd., NewDelhi	2013
3	Mike Martin and Roland Schinzinger	Ethics in Engineering	McGraw–Hill, NewYork	2005

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Tripathy P.C and Reddy P.N	Principles of Management	Tata McGraw Hill, New Delhi	2012
2	Rabindra N Kanungo	Entrepreneurship and innovation	Sage Publications, New Delhi	1998
3	Charles E Harris, and Michael J Rabins	Engineering Ethics – Concepts and Cases	Wadsworth Thompson Learning, New Delhi	2013

WEB REFERENCES
1. http://www.managementstudyguide.com/taylor_fayol.htm
2. http://tutor2u.net/business/gcse/people_motivation_theories.htm
3. http://lfkkb.tripod.com/eng24/gilliganstheory.html
4. http://www.developingeyes.com/five–types–of–entrepreneurs/

COURSE OBJECTIVES
1. To introduce the concepts of sensors and transducers.
2. To familiarize the students to understand the actuation systems.
3. To understand the importance of architecture of microprocessors.
4. To Study and acquire knowledge of the PLC program using ladder logic.
5. To introduce the concepts of design mechatronic system.
6. To provide an overview of develop the controller model for electrical, mechanical and thermal systems

COURSE OUTCOMES
1. Implement the concepts of sensors and transducers.
2. Design the actuation systems.
3. Understand the architecture of microprocessors.
4. Create the PLC program using ladder logic.
5. Design mechatronic system.
6. Develop the controller model for electrical, mechanical and thermal systems.

UNITI   MECHATRONICS SENSORS ANDTRANSDUCERS   9
Introduction to Mechatronics – Systems – Measurement Systems – Control Systems –Traditional design – Microprocessor based Controllers. Introduction to sensors – Performance Terminology – Static and Dynamic characteristics – Displacement – Position and Proximity – Velocity and Motion – Fluid Pressure – Temperature Sensors – Light Sensors – Selection of Sensors – Signal processing – Servosystems.

UNITII   ACTUATORS ANDSYSTEM MODELS   9
Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – D.C Motors – A.C Motors – Stepper Motors.
Introduction to system models– Building block of Mechanical, Electrical, Fluid and Thermal Systems.

UNITIII   MICROPROCESSORS INMECHATRONICS   9
Introduction – Architecture – pin configuration Instruction set – Programming of Microprocessors using 8085 instructions – Interfacing. Input and output devices – interfacing D/A converters and A/D converters – Application – Temperature control – Stepper motor control.

UNITIVCONTROLLERS   9
Introduction –Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode –Derivative Mode – Integral Mode – PID Controllers –Digital Controllers – Adaptive Control – Digital Logic Control – Micro Processors Control. Introduction to PLC – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Data Handling – Analog Input / Output – Selection of aPLC.

UNIT V   DESIGN OFMECHATRONICSYSTEMS   9
StagesindesigningMechatronicsSystems–TraditionalandMechatronicDesign–PossibleDesignSolutions
– Case Studies of Mechatronics Systems, Pick and place robot – automatic Car Park Systems – Engine Management Systems – Introduction to MEMS.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Bolton W	Mechatronics	Pearson Education, Delhi	2013

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Michael B. Histand David G. Alciatore	Introduction to Mechatronics and Measurement Systems	McGraw–Hill International Editions, New York	2012
2	Bradley D, Buru N.C and Loader A.J	Mechatronics	Chapman and Hall, Pearson Education Asia, New Delhi	2000
3	Ghosh P.K and Sridhar P.R	Introduction to Microprocessors for Engineers and Scientist	Prentice Hall of India, New Delhi	2009

WEB REFERENCE

1. www.cs.indiana.edu

17BEME7E --	PROFESSIONALELECTIVEV	3 0 0 3100

	OPENELECTIVEI	3 0 0 3100

	OPENELECTIVEII	3 0 0 3100

17BEME711	CAE /CAMLABORATORY	0 0 3 2100

(i) COURSE OBJECTIVES

1. To perform simple structural analysis and thermal analysis using simulation software's.
2. To perform structural analysis of bars andtrusses.
3. To perform structural analysis of beams andframes.
4. To perform 2D analysis of plate andshells
5. To perform modal analysis of simplesystems
6. To perform thermal analysis of simplesystems

COURSE OUTCOMES

Upon completion of this course, the Students will be able to
1. Perform structural analysis of bars andtrusses
2. Perform structural analysis of beams andframes
3. Perform 2d analysis of plate andshells
4. Perform modal analysis of simplesystems
5. Perform thermal analysis of simplesystems
6. Perform fluid and failure analysis of simplesystems

LIST OF EXPERIMENTS
COMPUTER AIDED ENGINEERING (Simple Analysis using ANSYS Tool)

1. Stress analysis of rectangular Lbracket
2. Stress analysis of beams (Cantilever, Simply supported, Fixedends)
3. Mode frequency analysis of beams (Cantilever, Simply supported, Fixedends)
4. Harmonic analysis of a 2Dcomponent
5. Thermal stress analysis of a 2Dcomponent
6. Modeling a 3D component. (Single point cutting tool, I beams,etc.,)

COMPUTER AIDED MANUFACTURING (CAM)

1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNCMachine.
2. Part programming for Linear, Circular interpolation, and Contourmotions.
3. Part programming using standard canned cycles for Thread cutting, Drilling, Peck drilling, andBoring.
4. NC code generation using software's like Edge CAM, CREO, etc. CNC Controllers likeFANUC, Siemens, and Hiedenhainetc.

TOTAL   45

17BEME712   **MECHATRONICSLABORATORY**   **0 0 3 2100**

COURSE OBJECTIVES
1. To introduce the program for arithmetic functions and the program for sorting, code conversion functions.
2. To enrich the understanding of the program codes to interface with stepper motor.
3. To understand the importance of set speed with actual speed of DC motor by interfacing suitable speed sensors.
4. To introduce the concepts of hydraulic, pneumatic by using simulation software.
5. To introduce the concepts of electro pneumatic circuits by using simulation software
6. To understand the concept of displacement, force and temperature measurement

COURSE OUTCOMES
1. Create the program for arithmetic functions
2. Create the program for sorting, code conversion functions.
3. Formulate the program codes to interface with stepper motor.
4. Compare the set speed with actual speed of DC motor by interfacing suitable speed sensors.
5. Integrate all the hydraulic, pneumatic and electro pneumatic circuits by using simulation software.
6. Perform the displacement, force and temperature measurement

LIST OF EXPERIMENTS
1. Design and testing of fluid power circuits tocontrol
   (i) Velocity (ii) direction and (iii) force of single and double actingactuators
2. Design of circuits with logic sequence using Electro pneumatic trainerkits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits usingsoftware
4. Circuits with multiple cylinder sequences in Electro pneumatic usingPLC.
5. Servo controller interfacing for openloop
6. PID controller interfacing
7. Stepper motor interfacing with 8051 Microcontroller
   (i) Full step resolution (ii) Half stepresolution
8. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LABVIEW
9. Computerized data logging system with control for process variables like pressure, flow andtemperature
10. Measurement of displace usingLVDT
11. Measurement of temperature usingThermocouples
12. Measurement of Force using StrainGage

                                                        TOTAL   **45**

17BEME791   **PROJECT WORKPHASEI**   **0 0 8 4100**

COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of theDepartment.

TOTAL   **120**

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.

UNIT I   **FUNDAMENTALS OFROBOT**   **5**

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 DigitizingImage.

UNIT II   **ROBOTCELLDESIGN**   **5**

Robotcelldesign–simulationsoftware(RoboWave).Robotcelllayouts–Multiplerobotsandmachineinterference–
robot cell planning – robot cycle time analysis for assembly, welding and painting shop.

UNIT III   **SAFETY CONSIDERATIONS**   **5**

Safety Considerations for Robot Operations, Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

                                                            TOTAL   **15**

REFERENCES

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	2012

COURSE OBJECTIVES
1. To understand the working principles ofpumps
2. To understand the working principles andmotors
3. To develop the system curve
4. To calculate the Net Positive Suction Head
5. To calculate the pump Total Head versus Rate of Flow characteristic
6. To match pumps to variable, parallel and series pumping systems

COURSE OUTCOMES
1. Understand the working principles ofpumps.
2. Understand the working principles andmotors.
3. Develop the system curve.
4. Calculate the Net Positive Suction Head.
5. Calculate the pump Total Head versus Rate of Flow characteristic.
6. Match pumps to variable, parallel and series pumping systems.

UNIT I   SINGLE PHASEINDUCTION MOTOR   5
Constructional details of single phase induction motor – Principle of operation – Types – Losses and Efficiency – Performance analysis – Starting methods of single–phase induction motors. – Design aspects of motors for usage in submersible pumps– Motors Rating and selection criteria.

UNIT II   THREE PHASE INDUCTION MOTOR   5
Constructional details – Types of rotors – Principle of operation – Need for starters – Types of starters – DOL, Stator resistance and reactance, rotor resistance, autotransformer and star–delta starters – Speed control – Change of voltage, torque, number of poles and slip – Losses and Efficiency – Performance analysis – Design aspects of motors for usage in submersible pumps – Motors Rating and selection criteria.

UNIT III   PUMPS   5
Pumps: definition and classifications – Sewage, fire fighting and Pressure boosting pumps
Classification, working principle, indicator diagram, work saved by air vessels and performance curves – cavitations in pumps – rotary pumps: working principles of gear and vane pumps

                                                                      TOTAL   15

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kothari, D. P., and Nagrath, I. J	Electric Machines	Tata McGraw Hill Publishing Company Ltd., New Delhi	2014
2	Bimbhra, P. S	Electrical Machinery	Khanna Publishers, New Delhi	2003

17BEME801	TOTALQUALITYMANAGEMENT	3 0 0 3100

COURSE OBJECTIVESS

1. To introduce the concepts of essentiality of quality.
2. To understand the importance of various TQM principles.
3. To introduce the concepts of the various TQM principles.
4. To Understand the techniques for quality management.
5. To introduce the standard quality systems in industries.
6. To familiarize the students to understand the various techniques to improve the quality in industries

COURSE OUTCOMES

1. Understand the essentiality of quality.
2. Summarize various TQM principles.
3. Understand the various TQM principles.
4. Understand the techniques for quality management.
5. Implement standard quality systems in industries.
6. Apply various techniques to improve the quality in industries.

UNIT I   ESSENTIALS OFTQM   9

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   TQMPRINCIPLES   9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III   TQMTOOLS   9

The new seven management 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 – APQP.

UNIT IV   TQMTECHNIQUES   9

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.

UNITV   QUALITY ANDENVIRONMENTSYSTEMS   9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2002 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 and ISO 18001 – Concept, Requirements and Benefits.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dale H.Besterfiled	Total Quality Management	Pearson Education, Delhi	2011

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Feigenbaum.A.V	Total Quality Control	McGraw Hill, New Delhi	2008
2	Oakland.J.S	Total Quality Management	Butterworth – Hcinemann Ltd., Oxford	2003
3	Narayana V. and SreenivasanN.S	Quality Management – Concepts and Tasks	New Age International Ltd., New Delhi	2007
4	Zairi	Total Quality Management for Engineers	WoodHead Publishers, New Delhi	1996

WEB REFERENCES:

1. http://auciello.tripod.com/14tqm.html
2. http://www.fkm.utm.my/~shari/download/toc%20paper%20hilma%20tqm%20dis06.pdf
3. http://www.businessgyan.com/node/5409
4. http://www.accelper.com/pdfs/SS_Measurements_Concepts.pdf
5. http://tutor2u.net/business/strategy/benchmarking.htm
6. http://www.trst.com/iso2a.htm

17BEME891   **PROJECT WORK - PHASE II&VIVA-VOCE**   **0 0 32 16300**

COURSE OBJECTIVES
1. To understand the concept and basics of thrust areas of Mechanical Engineering.
2. To explain the Review literature to identify gaps and define objectives & scope of the work.
3. To make the student appreciate the purpose of innovative ideas for social benefit.
4. To understand the importance of a prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. To familiarize the students to understand the methods and materials to carry out experiments/develop code.
6. To Reorganize the procedures with a concern for society, environment and ethics

COURSE OUTCOMES

1. Identify thrust areas of Mechanical Engineering.
2. Review literature to identify gaps and define objectives & scope of the work.
3. Generate and implement innovative ideas for social benefit.
4. Develop a prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. Identify methods and materials to carry out experiments/develop code.
6. Reorganize the procedures with a concern for society, environment and ethics

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of theDepartment.

TOTAL   **480**

| **17BEME5E01** | **MATERIAL ASPECTSINDESIGN** | **3 0 0 3100** |

COURSE OBJECTIVES

1. To select Material Properties have to suit the purpose of an application.
2. To designing a machine or component, many factors have to be considered and optimised.
3. To covers most issues for mechanical designoptimisation.
4. To know about the selective assembly process
5. To know about the fracture mechanism.
6. To know about spring design.

COURSE OUTCOMES

1. Sudents able to select material properties have to suit the purpose of an application.
2. create designing a machine or component, many factors have to be considered and optimised.
3. Solve most issues for mechanical designoptimisation.
4. selective assembly process
5. Finding of fracture mechanism of given material
6. Create spring design for Absorption system.

UNITI   MATERIAL SELECTIONINDESIGN   9

Introduction – relation of materials selection to design – general criteria for selection – performance characteristics of materials – materials selection process – design process and materials selection – economics of materials – recycling and materials selection

UNITII   MATERIALS PROCESSINGANDDESIGN   9

Role of Processing in Designing – classification of manufacturing processes – types of processing systems – factors determining process selection. Design for manufacturability, assembly, machining, casting, forging and welding

UNITIII   MANUFACTURING CONSIDERATIONSINDESIGN   9

Surface finish – texture – dimensional tolerances in fitting – interchangeability – selective assembly – geometric tolerance. Selection of fits and tolerances

UNITIV   MATERIALS PROPERTIES ANDDESIGN   9

Stress – Strain diagram – design for strength, rigidity – design under static loading, variable loading, eccentric loading – stress concentration. Design examples with shaft design, spring design and C frames.

UNITV   MATERIALS INDESIGN   9

Design for brittle fracture, fatigue failure, corrosion resistance. Designing with plastics, brittle materials

TOTAL   45

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Dieter George E	Engineering Design, A materials and processing approach, 3 rd Edition	McGraw Hill	2000
2	Bhandari	Design of Machine Elements	Tata McGraw Hill	2010

17BEME5E02   COMPUTER INTEGRATED MANUFACTURING   3 0 0 3100

COURSE OBJECTIVES
1. To understand the application of computers in various aspects of Manufacturing viz., Design, proper planning, Manufacturing cost, Layout & Material Handlingsystem.
2. To know the application of principles of group technology in computer aided processplanning.
3. To impart knowledge on working of the shop floorcontrol
4. To Study and acquire knowledge on data collection system in FMS.
5. To familiarize the students to understand CIM architecture for practicalapplication.
6. To expose students to generate database for computer integrated manufacturingprocesses.

COURSE OUTCOMES

Upon completion of this course, the student can able to
1. Implement computer integrated manufacturing concepts inindustries.
2. Apply the principles of group technology in computer aided processplanning.
3. Understand the working of the shop floorcontrol
4. Implement automated data collection system in FMS.
5. Develop CIM architecture for practicalapplication.
6. Generate database for computer integrated manufacturingprocesses.

UNITI   INTRODUCTION   9
The meaning and origin of CIM– the changing manufacturing and management scene – External communication – islands of automation and software–dedicated and open systems–manufacturing automation protocol – product related activities of a company– marketing engineering – production planning – plant operations – physical distribution– business and financial management.

UNITII   GROUPTECHNOLOGY   9
Group technology– – part families – Classification and coding – Approaches to computer aided process planning –variant approach and generative approaches

UNITIII   SHOP FLOOR CONTROL AND INTRODUCTIONOFFMS   9
Shop floor control–phases –factory data collection system –automatic identification methods– Bar code technology–automated data collection system. FMS–components of FMS – types –FMS workstation –material handling and storage systems– FMS layout –computer control systems–application and benefits.

UNITIV   CIM IMPLEMENTATION ANDDATACOMMUNICATION   9
CIM and company strategy – system modeling tools –IDEF models – activity cycle diagram – CIM open system architecture (CIMOSA)– manufacturing enterprise wheel–CIM architecture – Product data management–CIM implementation software. Communication fundamentals– local area networks –topology – LAN implementations – network management and installations –MRP, ERP concepts

UNITV   OPEN SYSTEM AND DATABASEFORCIM   9
Open systems–open system inter connection – manufacturing automations protocol and technical office protocol (MAP /TOP).
Development of databases –database terminology– architecture of database systems–data modeling and data associations –relational data bases – database operators – advantages of data base and relational database.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mikell.P.Groover	Automation, Production Systems and computer integrated manufacturing	Pearson Education, Delhi	2015

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Yoremkoren	Computer Integrated Manufacturing system	McGraw-Hill, New York	2005
2	Kant Vajpayee S	Principles of computer integrated manufacturing	Prentice Hall India, New Delhi	2003
3	Radhakrishnan P and Subramanyan S	CAD/CAM/CIM, 2nd Edition	New Age International (P) Ltd, New Delhi	2011

WEB REFERENCES

1. http://en.wikipedia.org/wiki/Computer-integrated_manufacturing
2. http://www.technologystudent.com/rmprp07/intman1.html
3. http://www.computerintegratedmanufacturing.com/

17BEME5E03   **AUTOMOBILE ENGINEERING**   **3 0 0 3100**

COURSE OBJECTIVES
1. To make the student acquire sound knowledge on the types of vehicle structures, cooling and lubrication systems required.
2. To acquaint the student with the concepts of type of engines to be used for modern automobiles.
3. To familiarize the students to Distinguish between the manual transmissions systems with automatic transmission systems.
4. To provide knowledge on appropriate transmission systems for the optimal power transmission.
5. To provide knowledge on steering, brakes and suspension systems for effective functioning.
6. To acquaint the student with advanced technologies in automotive Engineering.

COURSE OUTCOMES

1. Identify the types of vehicle structures, cooling and lubrication systems required.
2. Determine the type of engines to be used for modern automobiles.
3. Distinguish between the manual transmissions systems with automatic transmission systems.
4. Select appropriate transmission systems for the optimal power transmission.
5. Select steering, brakes and suspension systems for effective functioning.
6. Implement the advanced technologies in automotive.

UNITI   AUTOMOBILE ARCHITECTUREANDPERFORMANCE   9
Automotive components, subsystems and their positions – Chassis, frame and body, front, rear and four wheel drives – Operation and performance – Traction force and traction resistance, Power required for automobile– Rolling, air and gradient resistance.

UNITII   TYPES OFENGINES   9
Types of engines – multi valve engine – in–line engine, vee–engine, Petrol engine–direct – single point and multipoint injection, diesel engine–common rail diesel injection, supercharging and turbo charging – alternate fuels–ethanol and ethanol blend, compressed natural gas, fuel cells, hybrid vehicles**.**

UNITIII   TRANSMISSIONSYSTEMS   9
Clutch : Types – coil spring and diaphragm type clutch, single and multi plate clutch, centrifugal clutch, Gear box : Types – constant mesh, sliding mesh and synchromesh gear box, layout of gear box, gear selector and shifting mechanism, overdrive, automatic transmission, Propeller shaft, universal joint, slip joint, differential and real axle arrangement, hydraulic coupling.

UNITIV   WHEEL AND TYRES ANDSUSPENSIONSYSTEM   9
Types of wheels, construction, wired wheels, Tyres– construction, Radial, bias and belted bias, slip angle, Tread patterns, Tyre retreading - cold and hot, Tubeless tyres, Types–front and rear suspension, conventional and independent type suspension, leaf springs, coil springs, dampers, torsion bars, stabilizer bars, arms, air suspension systems – Balancing of Wheels.

UNITV   STEERING SYSTEM ANDBRAKINGSYSTEM   9
Types of steering systems, Ackermann principle, Davis steering gear, steering gear boxes, steering linkages, power steering, wheel geometry–caster, camber, toe–in, toe out etc., wheel Alignment. Braking System – Forces on vehicles, tyre grip, load transfer, braking distribution between axles, stopping distance, Types of brakes, Mechanical, Hydraulic, Air brakes, Disc and Drum brakes, Engine brakes and Anti lock braking system.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Gupta R.B	Automobile Engineering	Laxmi Publications, Chennai	2004
2	Kirpal Singh	Automobile Engineering Vol–I and II	Standard publishers, Delhi	2007

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Julian Happian Smith	An introduction to modern vehicle design	Butterworth Heinemann, New Delhi	2004
2	Crouse W H	Automotive transmissions and power trains	McGraw–Hill International Editions, New Delhi	1976
3.	Heniz Heisler	Vehicle and Engine Technology	Society of Automotive Engineers	2002

WEB REFERENCES:
1. http://en.wikipedia.org/wiki/Automotive_engineering
2. http://www.animatedengines.com/
3. http://www.automotive–online.com/transmission–system/
4. http://www.rqriley.com/suspensn.htm
5. http://en.wikipedia.org/wiki/Transmission_(mechanics)

17BEME5E04   **HYDRAULICS AND PNEUMATICS POWER CONTROL**   **3 0 0 3100**

COURSE OBJECTIVES

1. To recognize symbols and fundamentals in fluid power generation anddistribution.
2. To identify power source for hydraulicsystems.
3. To select appropriate components used in various hydraulicsystems.
4. To design hydraulic circuits for givenapplications
5. To distinguish the components used in pneumaticcircuits.
6. To create the logic circuits for controlling electro-hydraulic/ pneumaticsystems.

COURSE OUTCOMES

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

1. Recognize symbols and fundamentals in fluid power generation anddistribution.
2. Identify power source for hydraulicsystems.
3. Select appropriate components used in various hydraulicsystems.
4. Design hydraulic circuits for givenapplications
5. Distinguish the components used in pneumaticcircuits.
6. Create the logic circuits for controlling electro-hydraulic/ pneumaticsystems.

UNITI   FLUID POWER SYSTEMSANDFUNDAMENTALS   **9**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics–Applications of Pascals Law– Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves andfittings.

UNITII   HYDRAULIC SYSTEMANDCOMPONENTS   **9**

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, Pressure boosting pumps, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors, Rotary distributor.

UNITIII   DESIGN OFHYDRAULICCIRCUITS   **9**

Construction of Control Components : Direction control valve – 3/2 way valve – 4/2 way valve – Shuttlevalve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications ofIntensifier – Intensifiercircuit.

UNITIV   PNEUMATIC SYSTEMSANDCOMPONENTS   **9**

Pneumatic Components: Properties of air – Compressors – Filter, Regulator and Lubricator UNIT Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascademethod.

UNITV   DESIGN OFPNEUMATICCIRCUITS   **9**

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

                                                         TOTAL   **45**

17BEME5E04   **HYDRAULICS AND PNEUMATICS POWER**   **3 0 0 3100**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Anthony Esposito	Fluid Power with Applications	Pearson Education, New Delhi	2013
2	Majumdar S.R	Oil Hydraulics	Tata McGraw–Hill, New Delhi	2002

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Majumdar S.R	Pneumatic systems – Principles and maintenance	Tata McGraw Hill, New Delhi	2006
2	Anthony Lal	Oil hydraulics in the service of industry	Allied publishers, New Delhi	1982
3	Michael J, Prinches and AshbyJ.G	Power Hydraulics	Prentice Hall of India, New Delhi	1996

WEB REFERENCES

1. http://www.g–w.com/PDF/SampChap/60525_0816_Ch02.pdf
2. http://www.engineeringtoolbox.com/classification–pumps–d_55.html

17BEME5E05   DESIGN OF JIGS, FIXTURES AND PRESS TOOLS   3 0 0 3100

COURSE OBJECTIVES
1. To impart knowledge on the principles of locating and clamping devices in machining process.
2. To familiarize the students to understand design of jigs for a given component.
3. To Study and acquire knowledge on design fixtures for a given component.
4. To make the student acquire sound knowledge on appropriate type of press tool for a given component.
5. To expose students to drawing die for a given component.
6. To give exposure to the use computer aids for sheet metal forming analysis

COURSE OUTCOMES

1. Summarize the principles of locating and clamping devices in machining process.
2. Design jigs for a given component.
3. Design fixtures for a given component.
4. Design an appropriate type of press tool for a given component.
5. Develop a drawing die for a given component.
6. Use computer aids for sheet metal forming analysis

UNITI   PURPOSE TYPES AND FUNCTIONS OF JIGSANDFIXTURES   9
Tool design objective – Production devices – Inspection devices – Materials used in Jigs and Fixtures – Types of Jigs – Types of Fixtures–Mechanical actuation–pneumatic and hydraulic actuation–Analysis of clamping force–Tolerance and error analysis.

UNITII   JIGS   9
Drill bushes –different types of jigs–plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs–Automatic drill jigs–Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

UNITIII   FIXTURES   9
General principles of boring, lathe, milling and broaching fixtures– Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures– Modular fixtures, Quick change fixtures. Design and development of fixtures for given component.

**UNITIV   PRESS WORKING TERMINOLOGIES AND ELEMENTS OFDIESAND   9
                STRIP LAY OUT**
Press working terminology–Presses and press accessories–Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block–die shoe. Bolster plate–punch plate–punch holder–guide pins and bushes – strippers – knockouts–stops –pilots–Selection of standard die sets strip lay out–strip lay out calculations, SMEDtechnique.

UNIT V   DESIGN AND DEVELOPMENTOFDIES   9
Design and development of progressive and compound dies for Blanking and piercing operations. Tool and DIE Materials, Bending dies – development of bending dies–forming and drawing dies–Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

                                                                TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Edward G Hoffman	Jigs and Fixture Design	Thomson – Delmar Learning, Singapore	2012
2	Donaldson C	Tool Design	Tata McGraw–Hill, New Delhi	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Kempster	Jigs and Fixtures Design	Tata McGraw–Hill Publishing, New Delhi	2004
2	Joshi P.H	Jigs and Fixtures Second Edition	Tata McGraw–Hill Publishing Company Limited, New Delhi	2010
3	Hiram E Grant	Jigs and Fixture	Tata McGraw–Hill, New Delhi	2003

WEB REFERENCES

1. www.wisetool.com
2. www.invert–a–bolt.com
3. www.diemech.com
4. www.schaefertools.com
5. www.steelsmith.com

COURSE OBJECTIVES
1. To explain importance of renewable energy resources.
2. To understand the importance of basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. To understand the importance of principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.
4. To study the features ofdesign principles of biogas plants.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. To give exposure to power plants working with non-conventional energy

COURSE OUTCOMES

1. Understand the importance of renewable energy resources.
2. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.
4. Implement design principles of biogas plants.
5. Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.
6. Get exposure on the power plants working with non-conventional energy.

UNITI   ENERGYANDENVIRONMENT   9
Primary energy sources – world energy resources–Indian energy scenario–energy cycle of the earth – environmental aspects of energy utilisation, CO_2 emissions and Global warming–renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNITII   SOLARENERGY   9
Principles of solar energy collection – solar radiation – measurements – instruments – data and estimation–types of collectors – characteristics and design principles of different type of collectors – performance of collectors – testing of collectors. Solar thermal applications – water heaters and air heaters – performance and applications – simple calculations – solar cooling – solar drying – solar ponds – solar tower concept – solar furnace.

UNITIII   WIND, TIDAL AND GEOTHERMALENERGY   9
Energy from the wind – general theory of windmills – types of windmills – design aspects of horizontal axis windmills – applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants – power from geothermal energy – principle of working of geothermal power plants.

UNITIV   BIOENERGY   9
Energy from bio mass and bio gas plants –various types – design principles of biogas plants – applications. Energy from wastes – waste burning power plants – utilization of industrial and municipal wastes – energy from the agricultural wastes.

UNITV   OTHER RENEWABLEENERGYSOURCES   9
Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – thermoelectric generators – thermionic generators – fuel cells – solar cells – types, Emf generated, power output, losses and efficiency and applications. Hydrogen conversion and storage systems

                                                  TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rai G.D	AnNon conventional Energy sources	Khanna Publishers, New Delhi	2011
2	Duffie and Beckmann	Solar Energy Thermal Processes	John Wiley, London	2013

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	SukhatmeS.P	Solar Energy	Tata McGraw Hill, New Delhi	2010
2	Garg. H. P and Prakash J	Solar Energy - Fundamentals and applications	Tata McGrawHill, New Delhi	2007
3	Ashok V Desai	Non–conventional Energy	Wiley Eastern Ltd, New Delhi	2011

WEB REFERENCES

1. http://www.apricus.com/html/solar_typesofsolar.htm
2. http://www.solarserver.de/wissen/sonnenkollektoren–e.html
3. http://earthsci.org/mineral/energy/wind/wind.html
4. http://www.biomassgasification.com/

COURSE OBJECTIVES
1. To understand the anatomy, basic concepts and applications ofrobot.
2. To learn the drives and end effectors used inrobot.
3. To study the various types of sensors used inrobot.
4. To familiarize robot kinematics and robotprogramming
5. To provide knowledge on simple offline robot program
6. To impart knowledge on economic analysis ofrobots

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Identify the various types ofrobots.
2. Select appropriate drive systems and end effectors for industrialapplication.
3. Decide the types of sensors required according to the applications ofrobot.
4. To identify the different types of machine visiontechnologies
5. Develop simple offline robot program for differentapplications.
6. Calculate the economic analysis ofrobots.

UNITI   FUNDAMENTALS OFROBOT   9
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

UNITII   ROBOT DRIVE SYSTEMS ANDENDEFFECTORS   9
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives
End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNITIII   SENSORS ANDMACHINEVISION   9
Requirements of a sensor, Principles and Applications of the following types of sensors – Position sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors
Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

UNITIV   ROBOT KINEMATICS ANDROBOTPROGRAMMING   9
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems.
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

UNITV   IMPLEMENTATION ANDROBOTECONOMICS   9
RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method, Process application of Robots and Collaborativerobots.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Groover M.P	Industrial Robotics – Technology Programming and Applications	McGraw–Hill, New Delhi	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Fu.K.S., Gonzalz.R.C. and Lee C.S.G	Robotics Control, Sensing, Vision and Intelligence	McGraw–Hill Book Co., New Delhi	2008
2	Yoram Koren	Robotics for Engineers	McGraw–Hill Book Co., New Delhi	1992
3	Janakiraman. P.A	Robotics and Image Processing	Tata McGraw–Hill, New Delhi	1995

WEB REFERENCE
  1. www.learnaboutrobots.com/industrial.htm

COURSE OBJECTIVES
1. To provide foundations on design of experiments and statistical analysis of experimental data obtained from laboratory and/or industrialprocesses.
2. To understand the important concepts of single factorial designs
3. To Study and acquire knowledge on various methodologies involved in single factorial designs
4. To know the application of testing of factorial experiment
5. To enrich the understanding of special experimental designs
6. To impart knowledge on basic concepts of Taguchi method in parameter design

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:
1. Understand the knowledge of various techniques for experimentalplanning
2. Understand the concepts of single factorialdesigns
3. List the various methodologies involved in single factorialdesigns
4. Apply the concept of testing of factorialexperiment
5. Solve the partial and ordinary differential equations special experimentaldesigns
6. Apply the basic concepts of Taguchi method in parameterdesign

UNITI   INTRODUCTION   9
Planning of experiments – Steps – Need - Terminology: Factors, levels, variables, experimental error, replication, Randomization, Blocking, Confounding.

UNITII   SINGLEFACTOREXPERIMENTS   9
ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel's test, Duncan's Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

UNITIII   FACTORIALEXPERIMENTS   9
Main and interaction effects –Two and three Factor full factorial Designs, 2 k deigns with Two and Three factors-Unreplicated design- Yate's Algorithm

UNITIV   SPECIALEXPERIMENTALDESIGNS   9
Blocking in factorial design, Confounding of 2k design, nested design-Response Surface Methods.

UNITV   TAGUCHI TECHNIQUES   9
Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Montgomery, D.C	Design and Analysis of Experiments	John Wiley and Sons	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Hicks. C.R	Fundamental concepts in the Design of Experiments	Holt, Rinehort and Winston	2000
2	Bagchi. T.P	Taguchi Methods explained	PHI	2002
3	Ross. P.J	Taguchi Techniques for quality Engineering	Prentice Hall	2000

WEB REFERENCES

1. http://cran.r-project.org
2. http://www.itl.nist.gov/div898/handbook/
3. http://home.ubalt.edu/ntsbarsh/stat-data/Topics.htm

COURSE OBJECTIVES
1. To give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam power plant.
3. To make the student acquire sound knowledge of working of nuclear and hydel power plant.
4. To study the features of gas turbine power plant.
5. To make the student acquire sound knowledge of economics of the power plant.
6. To make the student acquire sound knowledge on renewable energy technologies and availability.

COURSE OUTCOMES

1. Select the accessories and layout required for a steam power plant depending upon the requirements.
2. Compute performance of steam power plant.
3. Explain the working of nuclear and hydel power plant.
4. Compute performance of gas turbine power plant.
5. Calculate the economics of the power plant.
6. Apply appropriate type of renewable energy technologies depending upon the application and availability.

UNITI   INTRODUCTION TO POWER PLANTSANDBOILERS   9
LayoutofSteam,Hydel,Diesel,MHD,NuclearandGasTurbinePowerPlants–CombinedPowerCycles–
Comparison and Selection, Load Duration Curves.
Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers – Industrial Standards.

UNITII   STEAM POWERPLANT   9
Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers

UNITIII   NUCLEAR AND HYDELPOWERPLANTS   9
Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety.
Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines– Micro Hydel developments.

UNITIV   DIESEL AND GAS TURBINEPOWERPLANT   9
Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant –Fuels – Gas Turbine Material – Open and Closed Cycles – Reheating – Regeneration and Intercooling – Combined Cycle.

UNITV   OTHER POWER PLANTS AND ECONOMICS OFPOWERPLANTS   9
Geo thermal –OTEC – Tidel – Pumped storage – Solar thermal central receiver system.
Safety aspects and Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing, comparison of economics of various power plants.

                                                TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Arora S.C and Domkundwar S	A course in Power Plant Engineering	Dhanpatrai Publishers, New Delhi	2013

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Nag P.K	Power plant Engineering	Tata McGraw Hill, New Delhi	2014
2	Rajput R.K	Power Plant Engineering	Laxmi Publications, Chennai	2015
3	Morse Frederick T	Power Plant Engineering	Prentice Hall of India, New Delhi	1998

WEB REFERENCES

1. www.solarpaces.org
2. www.igcar.gov.in
3. ga.water.usgs.gov
4. www.mapsofindia.com

COURSE OBJECTIVES
1. To provide knowledge on different aspects of powder metallurgy parameters.
2. To understand the importance of principle of advanced welding processes and its application.
3. To understand the importance of advanced forming processes and its application.
4. To familiarize the students to advanced manufacturing process for processing of different materials.
5. To acquaint the student to apply the suitable rapid prototyping mechanism for industry need.
6. To provide knowledge on optimum parametric for advanced manufacturing process

COURSE OUTCOMES

1. Understand different aspects of powder metallurgy parameters.
2. Understand basic principle of advanced welding processes and its application.
3. Understand basic principle of advanced forming processes and its application.
4. Select the best suitable advanced manufacturing process for processing of different materials.
5. Apply the suitable rapid prototyping mechanism for industry need.
6. Select the optimum parametric for advanced manufacturing process.

UNITI   POWDERMETALLURGYPROCESS   9
Introduction to powder metallurgy process – preparation of powders – types and functions of binders – green compaction – sintering process and its effect on the product.

UNITII   ADVANCEDWELDINGPROCESSES   9
Percussion Welding– Electro Slag Welding, Plasma Arc Welding – Thermit Welding – Electron Beam Welding – Friction and Inertia Welding – Friction Stir Welding – Under Water WeldingProcess.

UNITIII   SHEET METAL ANDFORMINGPROCESS   9
Sheet metal process –Laser welding and Cutting, Working principle and application of special forming process – Hydro Forming– Rubber Pad Forming– Explosive Forming – Magnetic Pulse Forming– Peen Forming – Super Plastic Forming – Deep Drawing Process.

UNITIV   ADVANCEDMACHININGPROCESS   9
Modern machining process: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, Electro chemical Machining, Electro chemical Grinding, Electro Discharge Machining, wire cut EDM, Electron Beam Machining, plasma arc machining, Laser Beam Machining. Ultrasonic Machining, High speed machining process – deep hole drilling process

UNITV   RAPIDPROTOTYPING   9
Introduction to Rapid Prototyping – Need for RPT– Stereo–lithography – Selective Laser Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, Solid Ground Curing, Ballistic Particle Manufacturing

                                              TOTAL   **45**

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Seropekalpakjian and Steven.R. Schmid	Manufacturing process for engineering materials	Pearson Education, Inc	2010
2	O.P.Khanna	A Textbook OfWWelding Technology	Dhanpat Rai Publications Pvt Ltd	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	P.N. Rao	Manufacturing technology Volume I	TMH Ltd	2013
2	Singh, M.K	Unconventional Manufacturing Process	New age international	2010
3	Vijay.K Jain	Advanced Machining Processes	Allied Publishers Pvt. Ltd	2009

WEB REFERENCES
1. http://mfg.eng.rpi.edu/gmp/WebChapters/ch39.pdf
2. http://web.iitd.ac.in/~pmpandey/MEL120_html/RP_document.pdf
3. http://www.me.psu.edu/lamancusa/rapidpro/rpintro2.pdf
4. http://file.guiacnc.com.br/data/PDF/PrototypeeBook2.pdf

COURSE OBJECTIVES
1. To introduce Governing Equations of viscous fluidflows
2. To introduce numerical modeling and its role in the field of fluid flow and heattransfer
3. To enable the students to understand the various discretization methods, solution procedures and turbulencemodeling.
4. To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speedcomputers.
5. To equip them with skills to solve convection and diffusionproblems
6. To understand the importance continuity and momentum equations for different types of fluidflow

COURSE OUTCOMES

Upon completion of this course, the students can able
1. Identify, solve engineering problems by computational fluiddynamics.
2. Understand the importance of governing equations involved inCFD
3. Formulate and solve problems in the field of fluid flow and heattransfer.
4. Solve the heat conduction problems using finite differencemethod.
5. Analyze and provide solutions for convection and diffusionproblems.
6. Develop continuity and momentum equations for different types of fluidflow

UNITI   **GOVERNING EQUATIONS ANDBOUNDARYCONDITIONS**   **9**
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 Hyperbolicequations.

UNITII   **DISCRETIZATION ANDSOLUTIONMETHODOLOGIES**   **9**
MethodsofDerivingtheDiscretizationEquations–TaylorSeriesformulation–Finitedifferencemethod–
Control volume Formulation – Spectral method.
Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNITIII   **HEATCONDUCTION**   **9**
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

UNITIV   **CONVECTIONANDDIFFUSION**   **9**
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.

UNITV   **CALCULATION OFFLOWFIELD**   **9**
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–ε) models.

           TOTAL   **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Versteeg H.K and Malalasekera.W	An Introduction to Computational Fluid Dynamics	Pearson education ltd, UK	2010
2	GhoshdastidarP.S	Computer Simulation of flow and heat transfer	Tata McGraw–Hill Publishing Company Ltd., New Delhi	1998

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	PatankarS.V	Numerical Heat Transfer and Fluid Flow	McGraw–Hill book company, New Delhi	1980
2	Muralidhar K and Sundarajan T	Computational Fluid Flow and Heat Transfer	Narosa Publishing House, New Delhi	2013
3	BoseT.K. Jain	Numerical Fluid Dynamics	Narosa publishing House, New Delhi	2005

WEB REFERENCES

1. http://www.ams.org/mcom//.pdf
2. http://www.cham.co.uk/website/new/cfdintro.htm
3. http://www.mechartes.com/
4. http://www.technologystudent.com
5. http://web.njit.edu/topics/Prog_Lang_Docs/html/FLUENT/fluent/fluent5/ug/html/node594.htm

17BEME6E04   MANUFACTURE AND INSPECTION OF GEARS   3 0 0 3100

COURSE OBJECTIVES
1. To gain knowledge in production, gear materialselection
2. To introduce the concepts of gear manufacturing
3. To Study and acquire knowledgeon mechanism involve in conicalgears
4. To Study and acquire knowledge on the procedures that involves in gear materialselection
5. To expose students to detailed view of gear finishingmethods
6. To impart knowledge modern gear productionmethods

COURSE OUTCOMES

Upon the completion of this course the students will be able to
1. Understand the overview on classification of gears and itterminology
2. Explain the various methods of gear manufacturing
3. Understands the concepts and mechanism involve in conicalgears
4. Understand the procedures that involves in gear materialselection
5. Attain a detailed view of gear finishingmethods
6. Understanding the modern gear productionmethods

UNITI   INTRODUCTIONTOGEARS   9
Types of gears-classification, application of gears, gearboxes, drawings for gears, gear production method an overview, types of blanks and blank preparation. Production Of Cylindrical Gears: Procedure of cutting gears and obtainable quality in hobbing and gear shaping, cutter selection and work holding methods, setting calculations. Rack type gear shaping machine description and application. Internal gear cutting methods, CNC gear hobbing and gear shapingmachines.

UNITII   PRODUCTION OFCONICALGEARS   9
Production of straight bevel gears by bevel gear generator, duplex rotary cutter method, Gleason Reva cycle method, spiral and hybrid bevel gear generation. Description of machine, cutter and machine setting.

UNITIII   GEAR MATERIAL SELECTION ANDHARDENINGMETHODS   9
Properties of gear materials-non-metallic, non-ferrous and plastic gears, selection of material for power transmission, high speed application. Selection of material for worm and wheel. Hardening by through hardening, case hardening, induction hardening, flame hardening, nitriding and tuftriding, hardening defects.

UNITIV   GEARFINISHINGMETHODS   9
Gear finishing advantages, finishing of gears by grinding, shaving, lapping and honing methods, cold rolling of gears - description of process, machine, cutters and process parameters setting.
Gear Inspection: Type of gear errors-gear quality standards and allowable limits-tooth thickness, base tangent length measurement, pitch error, radial run out, involute profile error measurements methods and analysis, composite error measurement, computerized gear inspection, gear failure reasons and remedies.

UNITV   MODERN GEARPRODUCTIONMETHODS   9
Gear production by stamping, die casting, powder metal process, injection and compression moulding of plastic gears, cold and hot rolling. Mass production methods, shear speed shaping, gear broaching, Gleayson G-TRAC – gear generation methods. Economical and Quality Production of Gears: Gear production systems – batch production, gear production cells, lean and agile production practices, automobile gear and gear boxes, heavy engineering gear production, gear for instruments and appliances, process and cutter selection for quantity, cost and qualitycriteria.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Watson	Modern Gear Production	Persman Press, Oxford	1984
2	HMT	Production Technology	Tata McGraw Hill Co., New Delhi	1992

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	SAE	Gear Design Manufacturing Inspection Manual	Persman Press, Oxford	1990
2	Weck .M	Hand Book of Machine Tools Technology and Sun Gear Technology	Magazine Back Volumes	1984

WEB REFERENCES
1. www.geartechnology.com
2. www.gearsolutions.com

17BEME6E05   DESIGN FOR MANUFACTURE AND ASSEMBLY   3 0 0 3100

COURSE OBJECTIVES

1. To understand the importance of the DFM approach and guidelines
2. To enrich the understanding of the selective assembly and Datum systems
3. To introduce the concepts of demonstrate true Position tolerancing theory.
4. To develop an understanding of the standard techniques and redesigning cast members using weldments and plastic component manufacturing.
5. To equip them with skills on Tolerance Charting Technique.
6. To Study and acquire knowledge of the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

COURSE OUTCOMES

Upon completion of this course, the students will be able to,
1. Understand the DFM approach and guidelines
2. Understand the selective assembly and Datum systems
3. Demonstrate true Position tolerancing theory.
4. Understand redesigning cast members using weldments and plastic component manufacturing.
5. Demonstrate the Tolerance Charting Technique.
6. Know the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

**UNITI   DFM APPROACH, SELECTION AND SUBSTITUTION OFMATERIALSIN   9
             INDUSTRY**
DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka – Yoke principle; 6σ concept; 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.

UNITII   SELECTIVEASSEMBLY   9
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.
Datum Systems: Grouped datum systems–different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, and tongue–slot pair, computation of translational and rotational accuracy.

UNITIII   TRUE POSITIONTOLERANCINGTHEORY   9
Comparison between co–ordinate and convention method of feature location tolerancing and true position tolerancing, zero true position tolerance, virtual size concept, floating and fixed fasteners, projected tolerance zone, functional gauges, paper layout gauging, compound assembly, examples.

UNITIV   FORM DESIGN OF CASTINGSANDWELDMENTS   9
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.

UNITV   TOLERANCECHARTING   9
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.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Harry Peck	Designing for Manufacture	Pitman Publications, London	1983
2	Matousek R	Engineering Design – A Systematic Approach	Blackie and Son Ltd., London	1974

REFERENCES

S. No.	Author(s) Name	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	Hand Book of Product Design for Manufacturing	McGraw Hill Publications, New Delhi	1986
4	Creveling C M	Tolerance Design – A Hand Book for Developing Optimal Specifications	Addison Wesley Longman Inc	1997

WEB REFERENCES
1. www.dfma.com
2. www.design4manufacturability.com

COURSE OBJECTIVES

1. To understand the basic difference between incompressible and compressibleflow.
2. To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and RocketPropulsion.
3. To introduce the concepts of various conditions of compressible fluidflows
4. To Study and acquire knowledge on performance analysis of subsonic and supersonicinlets, combustors, afterburners and exhaustnozzles
5. To understand the concept of working of various types of rocketengines
6. To study the features of thrust equation for rocket propulsionsystem

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Analyze various conditions of compressible fluidflows.
2. Calculate mass flow rate in flow through variable areaducts.
3. Carryout simple performance analysis of subsonic and supersonicinlets.
4. Perform performance analysis of combustors, afterburners and exhaustnozzles.
5. Understand the working of various types of rocketengines
6. Use thrust equation for rocket propulsionsystem.

UNITI   BASIC CONCEPTS ANDISENTROPICFLOWS   9

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Machcone –Effect of Mach number on compressibility – Isentropic flow through variable area ducts – Nozzle and Diffusers –area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles. Use of Gas tables.

UNITII   FLOW THROUGHDUCTS   9

Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – Variation of flow properties – Isothermal flow with friction in constant area ducts –Use of tables and charts – Generalised gas dynamics.

UNITIII   NORMAL ANDOBLIQUESHOCKS   9

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

UNITIV   JETPROPULSION   9

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines – Aircraft combustors.

UNITV   ROCKETPROPULSION   9

Types of rocket engines – Propellants – Ignition and combustion – Theory of rocket propulsion – solid and liquid propellants, comparison of different propulsion systems .Performance study – Staging – Terminal and characteristic velocity – Applications – Space flights.

TOTAL   45

(Permitted to use standard Gas Tables in the examination)

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Yahya.S.M	Fundamentals of Compressible flow	New Age International (P) Ltd., New Delhi	2009
2	Rathakrishnan.E	Gas Dynamics	Prentice Hall of India, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Patrich.H.Oosthvizen, WillamE.Carscallen	Compressible fluid flow	McGraw–Hill	1997
2	Zucker,R.D. and Biblarz,O	Fundamentals of Gas Dynamics	John Willey	2002
3	Ganesan .V	Gas Turbines	Tata McGraw–Hill, New Delhi	2010
4	P.Hill and C. Peterson	Mechanics and Thermodynamics of Propulsion	Addison –Wesley Publishing Company	1992

WEB REFERENCES
1. http://www.adl.gatech.edu/classes/ae3021/ae3021_f06_6.pdf
2. http://www.grc.nasa.gov/WWW/k–12/airplane/isndrv.html
3. http://panoramix.ift.uni.wroc.pl/~maq/papers/PM_Correct_Matyka.pdf
4. http://soliton.ae.gatech.edu/people/jseitzma/classes/ae3450/StudyProblems.pdf
5. http://www.sil.si.edu/smithsoniancontributions/AnnalsofFlight/pdf_lo/SAOF–0001.4.pdf

COURSE OBJECTIVES

1. To understand the underlying principles of operation of different IC Engines andcomponents.
2. To provide knowledge on pollutant formation, control, alternate fueletc.
3. To Study and acquire knowledge to Identify parts, terminology and fuel supply system of internal combustionengine
4. To introduce the concepts of cooling and lubrication systems of ICengines
5. To make the student acquire sound knowledge on combustion, knocking and super charging of internal combustionengines
6. To expose students to recent trends associated with ICengines

COURSE OUTCOMES

Upon completion of this course, the students can able to
1. Explain the construction and operation of internal combustionengine.
2. Identify parts, terminology and fuel supply system of internal combustionengine.
3. Recognize the component used in cooling and lubrication systems of ICengines.
4. Describe the function of combustion, knocking and super charging of internal combustionengines.
5. Implement strategies for pollution control.
6. Know about the recent \trends associated with ICengines

UNITI   SPARKIGNITIONENGINES   9
Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNITII   COMPRESSIONIGNITIONENGINES   9
Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbocharging.

UNITIII   POLLUTANT FORMATIONANDCONTROL   9
Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Drivingcycles.

UNITIV   ALTERNATIVEFUELS   9
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - EngineModifications.

UNITV   RECENTTRENDS   9
Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - OnboardDiagnostics.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ramalingam. K.K	Internal Combustion Engine Fundamentals	Scitech Publications	2002
2	Ganesan	Internal Combustion Engines	TMH	2002

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mathur. R.B. and R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons	2007
2	Duffy Smith	Auto Fuel Systems	The Good Heart Willcox Company, Inc.	1987
3	Eric Chowenitz	Automobile Electronics	SAE Publications	1995

COURSE OBJECTIVES
1. To explain the steps involved in FEA and also the types of weight residual methods
2. To impart knowledge to formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. To enrich the understanding of two dimensional thermal and torsion problems.
4. To enrich the understanding of axisymmetric bodies, plate and shell.
5. To develop an understanding of the standard techniques on matrix solution techniques to dynamic problems.
6. To impart knowledge on FE equation for structural, heat transfer and vibration problems.

COURSE OUTCOMES

1. Explain the steps involved in FEA and also the types of weight residual methods
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Predict finite element equations for two dimensional thermal and torsion problems.
4. Predict finite element equations for axisymmetric bodies, plate and shell.
5. Apply matrix solution techniques to dynamic problems.
6. Formulate FE equation for structural, heat transfer and vibration problems.

UNITI   INTRODUCTION   9
Historicalbackground–Matrixapproach–Applicationtothecontinuum–Discretization–Matrixalgebra–
Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritzmethod

UNITII   ONEDIMENSIONALPROBLEMS   9
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

UNITIII   TWODIMENSIONALCONTINUUM   9
Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galerkin approach – Stress calculation – Temperature effects

UNITIV   AXISYMMETRICCONTINUUM   9
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

UNITV   ISOPARAMETRIC ELEMENTS FOR TWODIMENSIONALCONTINUUM   9
The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness integration – Stress calculations – Four node quadrilateral element.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rao S.S	The Finite Element Method in Engineering	Butter worth Heinemann imprint, USA	2011
2	Khanka S.S	A First course in the Finite Element Method	Cengage Learning, Stamford, USA	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Chandrupatla T.R., and BelegunduA.D	Introduction to Finite Elements in Engineering	Pearson Education, Delhi	2011
2	David V Hutton	Fundamentals of Finite Element Analysis	McGraw–Hill Int. Ed, New York	2007

WEB REFERENCES
1. http://nptel.iitm.ac.in/courses/Webcourse–contents/IIT–KANPUR/mathematics–2/node18.html
2. http://www.me.berkeley.edu/~lwlin/me128/FEMNotes.pdf
3. http://www.rose–hulman.edu/~fine/FE2004/Class2/Notes2.pdf
4. http://www.asiri.net/courses/meng412/m412sm04ex1sol.pdf
6. http://hyperphysics.phy–astr.gsu.edu/hbase/electric/laplace.html

COURSE OBJECTIVES

1. To gain knowledge in design and material selection of various machinetools.
2. To provide an overview of regulation of speeds and feeds
3. To study the features of machine toolstructures
4. To understand the importance of constructional features of machine toolstructures
5. To expose students to design in machine tool structures, guide ways, power screws andspindles
6. To expose students to design spindles and spindlesupports

COURSE OUTCOMES

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

1. Discuss the basics machine tool drives andmechanisms
2. Get knowledge on regulation of speeds and feeds
3. Understand the importance of machine toolstructures
4. Explain the constructional features of machine toolstructures
5. Design in machine tool structures, guide ways, power screws andspindles
6. Design spindles and spindlesupports

UNITI   INTRODUCTION TO MACHINE TOOL DRIVESANDMECHANISMS   9

Introduction to the course, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission

UNITII   REGULATION OF SPEEDSANDFEEDS   9

Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design

UNITIII   DESIGN OF MACHINETOOLSTRUCTURES   9

Functions of Machine Tool Structures and their Requirements, Design for Strength, Design for Rigidity, Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages

UNITIV   DESIGN OF GUIDEWAYS, POWER SCREWSANDSPINDLES   9

Functions and Types of Guideways, Design of Guideways, Design of Aerostatic Slideways, Design of Anti-Friction Guideways, Combination Guideways, Design of Power Screws.

UNITV   DESIGN OF SPINDLES AND SPINDLESUPPORTS   9

Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, Antifriction Bearings. Dynamics of Machine Tools - Machine Tool Elastic System, Static and Dynamic Stiffness

                                        TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Sen, G.C. and Bhattacharya, A	Principles of machine tools	New Central Book Agency, Calcutta	2006

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Chernov N	Machine Tools	Mir publishers Moscow	1984
2	N.K. Mehta	Machine Tool Design and Numerical Control	TMH, New Delhi	2012
3	G.C. Sen and A. Bhattacharya	Principles of Machine Tools	New Central Book Agency	2009
4	D. K Pal, S. K. Basu	Design of Machine Tools	Oxford IBH	2008
5	N. S. Acherkhan	Machine Tool Design	MIR publications	1968

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 introduce process involved in Additive manufacturingtechnology
4. To understand the importance of knowledge on software's used in additive manufacturingtechnology
5. To enrich the understanding of the working of SLS and othertechniques
6. To provide an overview of additive manufacturing technology in medicalfield and biostream

COURSE OUTCOMES

On completion of this course, students will be able to

1. Understand the need for additive manufacturingtechnology
2. Explain the process involved in Additive manufacturingtechnology
3. Get knowledge on software's used in additive manufacturingtechnology
4. Describe the working of SLS and othertechniques
5. Apply the additive manufacturing technology in medicalfield
6. Applications of additive manufacturing technology in biostream

UNITI   INTRODUCTION   9

Overview – History - Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling - Applications.

UNITII   CAD & REVERSEENGINEERING   9

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Softwares for Additive Manufacturing Technology: MIMICS,MAGICS.

UNITIII   LIQUID BASED AND SOLID BASED ADDITIVEMANUFACTURINGSYSTEMS   9

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

UNITIV   POWDER BASED ADDITIVEMANUFACTURINGSYSTEMS   9

Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three Dimensional Printing - Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron BeamMelting.

UNITV   MEDICAL ANDBIO-ADDITIVEMANUFACTURING   9

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

                                                                TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Chua C.K., Leong K.F., and Lim C.S	Rapid prototyping: Principles and applications	World Scientific Publishers	2010
2	Gebhardt A	Rapid prototyping	Hanser Gardener Publications	2003

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Liou L.W., LiouF.W	Rapid Prototyping and Engineering applications	CRC Press	2007
2	Kamrani A.K. and Nasr E.A	Rapid Prototyping: Theory and practice	Springer	2015
3	Hilton P.D, Jacobs P.F	Rapid Tooling: Technologies and Industrial Applications	CRC press	2000

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. To introduce the concepts of carbon-carbon composite for different industrialapplication
6. To impart knowledge on various 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 industrialapplication.
6. Explain the various advances incomposites

UNITI   INTRODUCTIONTOCOMPOSITES   9

Fundamentalsofcomposites-needforcomposites–Enhancementofproperties-classificationofcomposites
– Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types ofcomposites.

UNITII   POLYMERMATRIXCOMPOSITES   9

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   METALMATRIXCOMPOSITES   9

Characteristics of MMC, Various types of Metal matrix composites Alloys - 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 – squeezecasting.

UNITIV   CERAMICMATRIXCOMPOSITES   9

Engineeringceramicmaterials–properties–advantages–limitations–Monolithicceramics-NeedforCMC
– 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).

UNITV   ADVANCES INCOMPOSITES   9

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.

                                                                TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Mathews F.L and Rawlings R.D	Composite materials Engineering and Science	Wood head publishing Ltd, England	2006
2	Chawla K.K	Composite materials	Springer – Verlag, , New York	2012

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Clyne T.W and Withers P.J	Introduction to Metal Matrix Composites	Cambridge University Press, New York	1995
2	Strong A.B	Fundamentals of Composite Manufacturing	Society of Manufacturing Engineering	2008
3	Sharma S.C	Composite materials	Narosa Publications, New Delhi	2000

WEB REFERENCES

1. http://www.metu.edu.tr/~ckaynak/METE%20470.htm
2. http://www.springerlink.com/content/978–1–4020–8771–4
3. http://www.virginia.edu/bohr/mse209/chapter17.htm
4. http://www.virginia.edu/bohr/mse209/chapter10.htm

COURSE OBJECTIVES
1. To understand the underlying principles of operations in different Refrigeration & Air conditioning systems andcomponents.
2. To provide knowledge on design aspects of Refrigeration & Air conditioningsystems
3. To introduce the concepts on use of unconventional refrigerant system for industrialapplication
4. To expose students to properties of air using psychrometricchart
5. To provide knowledge on cooling load for a givensystem
6. To know the application of air conditioning system for industrial and domestic purpose

COURSE OUTCOMES
1. Calculate COP of various refrigerationcycles.
2. Choose appropriate refrigerants for variousapplications.
3. Identify the use of unconventional refrigerant system for industrialapplication.
4. Calculate the properties of air using psychrometricchart.
5. Calculate cooling load for a givensystem
6. Select the appropriate air conditioning system for industrial and domesticapplications.

UNIT I   REFRIGERATIONCYCLE   9
Review of thermodynamic principles of refrigeration. Concept of refrigeration system. Vapour compression refrigeration cycle – use of P–H charts – multistage and multiple evaporator systems – cascade system – COP comparison. Vapor absorption refrigeration system. Ammonia water and Lithium Bromide water systems. Steam jet refrigeration system

UNIT II   REFRIGERANTS, SYSTEM COMPONENTSANDBALANCING   9
Compressors – reciprocating and rotary (elementary treatment.) – Condensers – evaporators – cooling towers. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Refrigeration plant controls – testing and charging of refrigeration units. Balancing of system components. Applications to refrigeration systems – ice plant – food storage plants – milk –chilling plants – refrigerated cargo ships.

UNITIII   PSYCHROMETRY   9
Psychrometric processes– use of psychrometric charts – – Grand and Room Sensible Heat Factors – bypass factor – requirements of comfort air conditioning – comfort charts – factors governing optimum effective temperature, recommended design conditions and ventilation standards

UNITIV   COOLINGLOADCALCULATIONS   9
Types of load – design of space cooling load – heat transmission through building. Solar radiation –infiltration – internalheatsources(sensibleandlatent)–outsideairandfreshairload–estimationoftotalload–
Domestic, commercial and industrial systems – central air conditioning systems.

UNIT V   AIRCONDITIONING   9
Air conditioning equipments – air cleaning and air filters – humidifiers – dehumidifiers – air washers – condenser – cooling tower and spray ponds – elementary treatment of duct design – air distribution system. Thermal insulation of air conditioning systems. – Applications: car, industry, stores, and public buildings

                                TOTAL   **45**

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Manohar Prasad	Refrigeration and Air Conditioning	New Age International Ltd, New Delhi	2011
2	Arora. C.P	Refrigeration and Air Conditioning	Tata McGraw–Hill, New Delhi	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Roy.JDossat	Principles of Refrigeration	Pearson Education, New Delhi	2002
2	Jordon and Prister	Refrigeration and Air Conditioning	Prentice Hall of India PVT Ltd., New Delhi	1981
3	StoeckerN.F and Jerold W.Jones	Refrigeration and Air Conditioning	McGraw Hill, New Delhi	1986

WEB REFERENCES
1. http://nptel.iitg.ernet.in/Mech_Engg/IIT%20Kharagpur/Refrigeration%20and%20Air%20Conditioning.htm
2. http://www.ashrae.org/
3. http://en.wikipedia.org/wiki/Thermal_comfort

17BEME8E01   **QUALITY CONTROL AND RELIABILITY**   **3 0 0 3100**
                                    ENGINEERING

COURSE OBJECTIVES
1. To Understand the concept of SQC.
2. To enrich the understanding of control charts to analyze for improving the process quality.
3. To familiarize the students to understand different sampling plans
4. To Understand the importance of need and types of life testing.
5. To introducethe reliability of a system.
6. To introduce the concepts of quality control and reliability techniques in industries.

COURSE OUTCOMES
Upon the completion of this course the students will be able to
1. Understand the concept of SQC.
2. Use control charts to analyze for improving the process quality.
3. Describe different sampling plans
4. Understand the need and types of life testing.
5. Improve the reliability of a system.
6. Implement quality control and reliability techniques in industries.

UNITI   INTRODUCTION AND PROCESS CONTROLFORVARIABLES   **9**
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 σ chart.

UNITII   PROCESS CONTROLFORATTRIBUTES   **9**
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   ACCEPTANCESAMPLING   **9**
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.

UNITIV   LIFE TESTING– RELIABILITY   **9**
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.

UNITV   QUALITYANDRELIABLITY   **9**
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 – Maintenance.

                                                        TOTAL   45

Note: Permitted to use approved statistical table in the examination.

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Grant. Eugene .L	Statistical Quality Control	McGraw–Hill, New Delhi	2008
2	Srinath L.S	Reliability Engineering	Affiliated East west press New Delhi	2002

17BEME8E01   **QUALITY CONTROL AND RELIABILITY**   **3 0 0 3100**

ENGINEERING

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Manohar Mahajan	Statistical Quality Control	Dhanpat Rai and Sons, New Delhi	2003
2	Besterfield D.H	Quality Control	Prentice Hall, New Delhi	2004
3	Danny Samson	Manufacturing and Operations Strategy	Prentice Hall, New Delhi	1991
4	Connor P.D.T.O	Practical Reliability Engineering	John Wiley, New Delhi	2012

WEB REFERENCES
1. http://www.statsoft.com/textbook/stquacon.html
2. http://www.isixsigma.com/library/content/c010806a.asp
3. http://www.statgraphics.com/control_charts.htm
4. http://www.sqconline.com/sampling–plans.html
5. http://reliability.sandia.gov/Maintenance/Data_Failure_Analysis/data_failure_analysis.html
6. http://www.designinindia.net/everywhere/disciplines/product–design/index.html

17BEME8E02   PRODUCTION PLANNING AND CONTROL   3 0 0 3100

COURSE OBJECTIVES
1. To impart knowledge of need for planning and control in various aspects.
2. To develop an understanding of the standard techniques in various work study methodologies.
3. To familiarize the students to understand the product and process plan.
4. To introduce the concepts of a production schedule based on different facets.
5. To enrich the understanding of the level of inventory
6. To understand the importance the recent advancements in production planning and control.

COURSE OUTCOMES

1. Indicate the need for planning and control in various aspects.
2. Understand various work study methodologies.
3. Construct product and process plan.
4. Prepare a production schedule based on different facets.
5. Estimate the level of inventory
6. Understand the recent advancements in production planning and control.

UNITI   INTRODUCTION   9
Objectives: and benefits of planning and control–Functions of production control–Types of production–job–batch and continuous–Product development and design–Marketing aspect – Functional aspects–Operational aspect–Durability and dependability aspect–aesthetic aspect. Profit consideration–Standardization, Simplification and specialization–Break even analysis–Economics of a new design.

UNITII   WORKSTUDY   9
Method study, basic procedure–Selection–Recording of process – Critical analysis, Development – Implementation – Micro motion and memo motion study – work measurement – Techniques of work measurement – Time study – Production study – Work sampling – Synthesis from standard data – Predetermined motion time standards.

UNITIII   PRODUCT PLANNING ANDPROCESSPLANNING   9
Product planning–Extending the original product information–Value analysis–Problems in lack of product planning–Process planning and routing–Pre requisite information needed for process planning–Steps in process planning–Quantity determination in batch production–Machine capacity, balancing–Analysis of process capabilities in a multi product system.

UNITIV   PRODUCTIONSCHEDULING   9
Production Control Systems–Loading and scheduling–Master Scheduling–Scheduling rules–Gantt charts–Perpetual loading–Basic scheduling problems – Line of balance – Flow production scheduling–Batch production scheduling–Product sequencing – Production Control systems–Periodic batch control–Material requirement planning Kanban –Dispatching–Progress reporting and expediting–Manufacturing lead time–Techniques for aligning completion times and due dates.

UNITV   INVENTORY CONTROL AND RECENT TRENDSINPPC   9
Inventory control–Purpose of holding stock–Effect of demand on inventories–Ordering procedures.
Two bin system –Ordering cycle system–Determination of Economic order quantity and economic lot size–ABC analysis–Recorder procedure–Introduction to computer integrated production planning systems–elements of JIT Systems–Fundamentals of MRP and ERP, KANBAN system.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	MartandTelsang	Industrial Engineering and Production Management	S.Chand and Company, New Delhi	2006

17BEME8E02   **PRODUCTION PLANNING AND CONTROL**   **3 0 0 3100**

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Samson Eilon	Elements of production planning and control	Macmillan, India	1981
2	Elwood S.Buffa, and Rakesh K.Sarin	Modern Production Operations Management	John Wiley and Sons, New Delhi	2007
3	Jain C.K and Aggarwal L.N	Production Planning Control and Industrial Management	Khanna Publishers, New Delhi	1997

WEB REFERENCES
1. http://envfor.nic.in/divisions/iwsu/iwsu.html
2. http://src.edu/work–study
3. http://thequalityportal.com/articles/value.htm

**17BEME8E03   COGENERATION AND WASTE HEAT RECOVERY   3 0 0 3100
SYSTEMS**

COURSE OBJECTIVES

1. To study the significance of waste heat recovery systems and carry out its economicanalysis
2. To know the concepts of cogeneration, its types and probable areas ofapplications
3. To enrich the understanding of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of thisemerging technology.
4. To impart knowledge on operational issues and challenges cogenerationtechnologies.
5. To Understand the impact of this technology in waste heat recoverysystems
6. To introduce the concepts of various systems involved in waste heat recoveryprocess

COURSE OUTCOMES
The student will be able to
1. Understand the various methods ofcogeneration.
2. Apply knowledge of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of thisemerging technology.
3. Have thorough understanding, operational issues and challenges cogenerationtechnologies.
4. Understand the impact of this technology in waste heat recoverysystems
5. Get the knowledge over various systems involved in waste heat recoveryprocess
6. Begin a career as an engineer in an organization economicanalysis

UNITI   INTRODUCTION   9
Introduction – principles of thermodynamics – cycles – topping - bottoming – combined cycle - organic rankine cycles – performance indices of cogeneration systems – waste heat recovery – sources and types – concept of trigeneration.

UNITII   COGENERATIONTECHNOLOGIES   9
Configuration and thermodynamic performance – steam turbine cogeneration systems – gas turbine cogeneration systems – reciprocating IC engines cogeneration systems – combined cycles cogeneration systems – advanced cogeneration systems: fuel cell, Stirling enginesetc.,

UNITIII   ISSUES AND APPLICATIONS OFCOGENERATIONTECHNOLOGIES   9
Cogeneration plants electrical interconnection issues – utility and cogeneration plant interconnection issues – applications of cogeneration in utility sector – industrial sector – building sector – rural sector – impacts of cogeneration plants – fuel, electricity and environment

UNITIV   WASTE HEATRECOVERYSYSTEMS   9
Election criteria for waste heat recovery technologies - recuperators - Regenerators - Economizers - plate heat exchangers - thermic fluid heaters - Waste heat boilers classification, location, service conditions, design Considerations - fluidized bed heat exchangers - heat pipe exchangers - heat pumps – sorption systems.

UNITV   ECONOMICANALYSIS   9
Investment cost – economic concepts – measures of economic performance – procedure for economic analysis – examples – procedure for optimized system selection and design – load curves - sensitivity analysis– regulatory and financial frame work for cogeneration and waste heat recovery systems.

TOTAL   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	R.Kehlhofer, B. Rukes, F. Stirnimann	Combined-cycle gas & steam turbine power plants	PennWell Books	2009

17BEME8E03   COGENERATION AND WASTE HEAT RECOVERY   3 0 0 3100

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Steve Doty, Wayne C. Turner	Energy management handbook	The Fairmont Press, Inc	2009
2	A.Thumann, D. Paul Mehta	Handbook of energy engineering	The Fairmont Press Inc	2014
3	B.F.Kolanowski	Small-scale cogeneration handbook	Fairmont Press	2013
4	M.P. Boyce	Handbook for cogeneration and combined cycle power plants	ASME Press	2010
5	Educogen	The European Educational tool for cogeneration	Fairmont Press	2001

**17BEME8E04   ENERGY CONSERVATION METHODS AND ENERGY   3 0 0 3100
AUDIT**

COURSE OBJECTIVES
1. To understand and analyze the energy data ofindustries
2. To carryout energy accounting andbalancing
3. To conduct energy audit and suggest methodologies for energysavings
4. To utilize the available resources in optimalways
5. To make the students conversant with concepts of industrialfurnaces
6. To equip them with skills to perform Energyaudit

COURSE OUTCOMES
At the end of the course, student will be able to
1. Understand the Environmental aspects of energyutilization
2. Perform combustionanalysis
3. Explain the concepts of industrialboiler
4. understand how to work with the steam generated from the boilers in the industrial point ofview
5. Explain the concepts of industrialfurnaces
6. Perform Energyaudit

UNITI   ENERGYSCENARIO   9
Present status, rate of growth, energy utilization (sector wise), concept of energy conservation, energy economics.
COMBUSTION: Fuel analysis, combustion calculations, air requirements, theoretical and excess air requirements, excess air control, flue gas analysis and measurement, types of draught, draught calculations, chimney size calculations. F.D and I.D fan draught requirements and power requirements, furnace pressure requirements.

UNITII   INDUSTRIALBOILERS   9
Types and characteristics of industrial boilers, heat balance in boilers, efficiency trials in boilers, energy conservation opportunities in boilers operation and maintenance, water treatment requirements, soot blowing requirements, super heaters and superheat controls, waste heat recovery systems.
STEAM: Distribution requirements of steam and streamlines, efficient utilization of steam, steam trapping and air venting, flash steam recovery, condensate recovery, thermal insulation for systems including HVAC, stream balancecalculations.

UNITIII   INDUSTRIALFURNACES   9
Furnace types and characteristics, heat balance in furnaces, furnace efficiency calculations, energy conservation opportunities in furnaces, refractories types and properties, waste heat recovery system, insulating refractories, ceramic fibers, heat loss reduction calculations, wall and stored heat lossreduction.

UNITIV   DRYING   9
Principle of drying and types of driers, mass and heat balance in driers, energy conservation opportunities in drying operations.
EVAPORATION: Principle of evaporation and types of evaporations, mass and heat balance, single and multiple effect evaporation, capacity and steam economy calculations, vapour recompression system.

UNITV   ENERGY AUDIT ANDAPPLICATIONS   9
Types, methodology, questionnaire development, specific energy consumption (unitwise/section wise), identification of energy conservation measures/ technologies, economic and cost benefit analysis, case studies, Energy rating for thermal equipment ,Energy saving measurement – Star status –National awards.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Turner, W. C., Doty, and Truner, W. C	Energy Management Hand book	Fairmont Press	2009
2	De. B. K.	Energy Management audit & Conservation	Vrinda Publication	2016

17BEME8E04   ENERGY CONSERVATION METHODS AND ENERGY   **3 0 0 3100**
AUDIT

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Trinks M.H, W.Mawhinney	Industrial Furnaces	John Wiley Publications, London	2004
2	Prabir Basu, Cen Kefa, Louis Jestin	Boilers and Burners Design and Theory	Springer Publications, New Delhi	2012

WEB REFERENCES

1. www.energyconservation.co.in
2. www.energymanagertraining.com\
3. www.nrel.gov

17BESHOE01   PROBABILITY ANDRANDOMPROCESS   3 0 0 3100

COURSE OBJECTIVES

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 and to introduce some standard distributions applicable to engineering which can describe real lifephenomenon.
3. To understand the basic concepts of random processes which are widely used in ITfields.
4. To understand the concept of correlation and spectraldensities.
5. To understand the significance of linear systems with randominputs.
6. To understand the response of random inputs to linear time invariantsystems.

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 spectraldensities.
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   9

Measures of central tendency – Mean, Median, Mode - Standard Deviation Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye's theorem.

UNITII   STANDARDDISTRIBUTIONS   9

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   9

Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

UNITIV   CLASSIFICATION OFRANDOM PROCESS   9

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   9

Autocorrelation-Crosscorrelation-Properties–Powerspectraldensity–Crossspectraldensity–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.

                                                                    TOTAL   45

TEXT BOOK

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

OPEN ELECTIVES

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
4	Veerarajan,T.	Probabilitiy, Statistics and Random process	Tata McGraw-Hill Publications, Second Edition, New Delhi	2012

WEB REFERENCES

1. www.cut-theknot.org/probability.shtml
2. www.mathcentre.ac.uk
3. www.mathworld. Wolfram.com

COURSE OBJECTIVES

1. Be able to understand basic knowledge of fuzzy sets
2. Be able to understand basic knowledge of fuzzy logic
3. Be able to apply basic knowledge of fuzzy operations.
4. To know the basic definitions of fuzzy relations
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   **9**

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   **9**

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNITIII   FUZZYRELATIONS   **9**

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNITIV   FUZZYMEASURES   **9**

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNITV   FUZZYINFERENCE   **9**

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

                                                          TOTAL   45

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

WEB REFERENCES

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

COURSE OBJECTIVES
1. To introduce the basic concepts of vector space
2. To introduce the fundamental concepts in their respective engineering fields
3. To know the fundamentals of linear Algebra
4. To solve system of linear equations
5. To study about the linear transformations
6. To introduce the concepts of inner product spaces

COURSE OUTCOMES

1. To explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
2. To describe the fundamental concepts of Eigen values and Eigen vectors by using Power method.
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   9
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   9
Eigen values and Eigen vectors - diagonalization - Power method - QR decomposition

UNITIII   SYSTEM OF LINEAREQUATIONS   9
Direct methods, Gauss elimination method, Gauss Jordan method, Crout's method, iterative methods, Gauss-Jacobi method, Gauss–Seidel method, convergence criteria.

UNITIV   LINEARTRANSFORMATIONS   9
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   9
The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

TOTAL   45

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

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   9
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   9
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   9
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   9
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   9
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

                                                         TOTAL   45

TEXTBOOK

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. To make the students conversant with basics of Solid wastes
2. To learn the solid waste classification.
3. To make the student acquire sound knowledge of different treatments of solid wastes.
4. To acquaint the student with concepts of waste disposals.
5. To develop an understanding of the basic concepts of Hazardous waste managements.
6. To acquaint the students with the basics of energy generation from waste materials.

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   9
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   9
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   9
Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, 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   9
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   9
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   45

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
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

1. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
2. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
3. www.alternative-energy-news.info/technology/garbage-energy/
4. nzic.org.nz/ChemProcesses/environment/

COURSE OBJECTIVES
1. To make the students conversant about the green chemistry
2. To make the student acquire sound knowledge of the atom efficient process
3. To make the student acquire sound knowledge of the synthesis elaborately.
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's information on catalysis.

COURSE OUTCOMES
1. Outline the basic principles of green chemistry.
2. Examine the different atom efficient process and synthesis elaborately.
3. Apply the concepts combustion of green technology.
4. Identify and apply the concepts of renewable energy.
5. Apply the concepts of green catalysts in the synthesis.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNITI   INTRODUCTION TO GREENCHEMICALPRINCIPLES   9

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   9
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   9
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   9
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   9
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   45

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

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

WEB REFERENCES

1. http://www.organic-chemistry.org/topics/green-chemistry.shtm
2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
4. http://www.epa.gov/research/greenchemistry/
5. http://www.amazon.in/Green-Chemistry-Catalysis

17BESHOE07   **APPLIED ELECTROCHEMISTRY**   **3 0 0 3100**

COURSE OBJECTIVES
1. To get the information on electrochemical material.
2. To study about the conducting polymers.
3. To study about electrochemistry in storage devices
4. To acquaint the student with concepts of Energy storage devices.
5. To gain knowledge on the batteries and power sources.
6. To develop energy storage devices.

COURSE OUTCOMES
1. Outline the basic principles of chemistry in electrochemical material**.**
2. Examine the properties of conducting polymers.
3. Apply the concepts of electrochemistry in storage devices.
4. Identify the concepts of storage devices and its applications.
5. Apply the suitable materials for the manufacturing of storage devices.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNITI   METALFINISHING   9
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   9
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   9
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 ofelectrolytes.

UNITIV   BATTERIES ANDPOWERSOURCES-II   9
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   9
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   45

TEXTBOOKS

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

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/
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
3. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

17BESHOE08	INDUSTRIAL CHEMISTRY	3 0 0 3100

COURSE OBJECTIVES
1. To make the students conversant with **cement and lime**
2. To make the students to aware about uses of cement and lime.
3. To make the student acquire sound knowledge of abrasives and refractories.
4. To acquaint the student with concepts of inorganic chemicals.
5. To develop an understanding of the basic concepts**explosives**.
6. To acquaint the students with the basics of **agriculture chemicals**.

COURSE OUTCOMES
1. Outline the basic chemistry of **cement and lime.**
2. Examine the uses of abrasives and refractories.
3. Identify the usage of the inorganic chemicals.
4. Identify the concepts of explosives and smoke screens .
5. Identify the usage of the **agriculture** chemicals
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology .

UNITI   CEMENTANDLIME   9
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   9
Abrasives–hardabrasives–siliceousabrasives–softabrasives –artificialabrasives–uses.Refractories–
definition – classification – acid refractories – basic refractories – neutral refractories – properties – uses.

UNITIII   INORGANICCHEMICALS   9
Common salt and soda ash – Manufacture – Different grades – products – alkalis – Na_2CO_3, Caustic soda and chlor-alkali industry – manufacture principles of electrolytic process – chlorine – storage. Hydrochloric acid – manufacture–absorption–uses,Sulphurandsulphuricacid–extractionofsulphur–manufactureofH_2SO_4
– chamber – contact processes – industrialuses.

UNITIV   EXPLOSIVES   9
Explosives–uses–propertiesandtests–explosivesforwar–nitrocellulose–picricacidandT.N.T.–
industrial explosives – nitroglycerin and dynamites – black powder – smoke screens – incendiaries – gasmask.

UNITV   AGRICULTURECHEMICALS   9
Fertilizers – organic and inorganic – ammoniated superphosphates, sodium nitrate, solid pellets – potassium salts – pesticides – fungicides – herbicides – their preparations and characteristics – environmental impacts.

                                                                TOTAL   45

TEXTBOOKS

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

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

COMPUTER SCIENCE AND ENGINEERING

17BECSOE01   **INTERNETPROGRAMMING**   **3 0 0 3100**

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

UNIT I   INTRODUCTION

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

UNITII   HTML   9

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

UNITIII   PERL   9

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

UNITIV   CLIENT-SERVERPROGRAMMING   9

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.

UNITV   INTERNETTELEPHONY   9

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   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Paul Deitel, Harvey Deitel& Abby Deitel	Internet and World Wide Web-How to Program	PHI Learning, Delhi	2011
2	N.P. Gopalan and J. Akilandeswari	Web Technology: A Developer's Perspective	PHI Learning, Delhi	2013

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Rahul Banerjee	Internetworking Technologies, An Engineering Perspective	PHI Learning, Delhi	2011
2	Robert W. Sebesta	Programming the World Wide Web	Pearson Education	2016

COURSE OBJECTIVES

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
6. To understand the three-dimensional graphics and their transformations

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**   **9**

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 -Creating Animation.

UNITII   **CREATING ANIMATIONINFLASH**   **9**

Introduction to Flash Animation – Introduction to Flash – Working with the Timeline and Frame-based
Animation - Working with the Timeline and Tween-based Animation – Understanding Layers - Action script.

UNITIII   **3D ANIMATION &ITSCONCEPTS**   **9**

Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D
Camera Tracking – Applications & Software of 3D Animation

UNITIV   **MOTIONCAPTION**   **9**

Formats – Methods – Usages – Expression – Motion Capture Software's – Script Animation Usage – Different
Language of Script Animation Among the Software.

UNITV   **CONCEPTDEVELOPMENT**   **9**

Story Developing –Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma
Correction - Production Budgets- 3D Animated Movies.

                                           TOTAL   **45**

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Malay K. Pakhira	Computer Graphics, Multimedia and Animation	PHI Learning	2010

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Ranjan Parekh	Principles of Multimedia	TMH	2007
2	Ashok Banerji, Ananda Mohan Ghosh	Multimedia Technologies	McGraw Hill Publication	2007
3	Pankaj Dhaka	Encyclopedia of Multimedia and Animations	Anmol Publications	2011

17BECSOE03   PC HARDWARE AND TROUBLE SHOOTING   3 0 0 3100

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 OUTCOMES
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   9
Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC andUser.

UNITII   PERIPHERALDEVICES   9
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   9
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   9
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   9
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.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	B. Govindarajalu	IBM PC Clones Hardware, Troubleshooting and Maintenance	TMH	2002

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Peter Abel, Niyaz Nizamuddin	IMB PC Assembly Language and Programming	Pearson Education	2007
2	Scott Mueller	Repairing PC's	PHI	1992

17BECSOE04	JAVA PROGRAMMING	3 0 0 3100

COURSE OBJECTIVES
1. To understand the basic history and genres ofgames
2. To demonstrate an understanding of the overall game designprocess
3. To explain the design tradeoffs inherent in gamedesign
4. To design and implement basic levels, models, and scripts forgames
5. To describe the mathematics and algorithms needed for gameprogramming
6. To design and implement a complete three-dimensional videogame

COURSE OUTCOMES
Upon completion of the course, students will be able to:
1. Develop Java programs using OOP principles
2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes and swings
5. Understand various aspects for motivation of generic programming
6. Develop various interactive Java programs using OOP concepts of Java

UNITI   INTRODUCTIONTOJAVA   9
Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation–inheritance–abstractclasses–polymorphism.-ObjectsandclassesinJava–definingclasses – methods - access specifiers – static members –constructors – finalizemethod

UNITII   PACKAGES   9
Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy –polymorphism – dynamic binding – final keyword – abstract classes

UNITIII   I/OSTREAMS   9
The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes

UNITIV   EXCEPTIONHANDLING   9
Exceptions–Syntaxofexceptionhandlingcode–Multiplecatchstatements–Usingfinallystatements–
Throwing our own exceptions – Using exceptions for debugging

UNITV   THREADS   9
Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads, Summary

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Cay S. Horstmann and Gary Cornell	Core Java: Volume I – Fundamentals Sun Microsystems	Press	2008

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	K. Arnold and J. Gosling	The JAVA programming language	Pearson Education	2009
2	Timothy Budd	Understanding Object-oriented programming with Java Updated Edition	Pearson Education	2002
3	C. Thomas Wu	An introduction to Object-oriented programming with Java Fourth Edition	Tata McGraw-Hill Publishing company Ltd	2008

WEB REFERENCES

1. http://elvis.rowan.edu/~kay/cpp/vc6_tutorial/
2. http://www.winprog.org/tutorial/msvc.html
3. http://www.tutorialized.com/tutorials/Visual-C/1
4. http://www.freeprogrammingresources.com/visualcpp.html

ELECTRICAL AND ELECTRONICS ENGINEERING

17BEEEOE01   **ELECTRICHYBRIDVEHICLES**   **3 0 0 3100**

COURSE OBJECTIVES
1. To understand the basic concepts of electric hybrid vehicle.
2. To gain the knowledge about electric propulsion unit.
3. To gain the concept of Hybrid Electric Drive-Trains.
4. To gain the different Energy Management Strategies.
5. To study about the efficiency manipulation in drives
6. To understand and gain the knowledge about various energy storage devices

COURSE OUTCOMES
1. Summarize the basic concepts in bioprocess Engineering.
2. Explain the concept of Hybrid Electric Vehicles.
3. Understand the concept of Hybrid Electric Drive-Trains.
4. Identify the different Energy Management Strategies.
5. Understand the concept of different Energy Storage devices.
6. Analyze the different motor drives used in Hybrid Electric Vehicles.

UNITI   INTRODUCTION   9
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   9
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNITIII   ELECTRICPROPULSIONUNIT   9
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   9
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   9
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   45

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
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

17BEEEOE02   ENERGY MANAGEMENT & ENERGY AUDITING   3 0 0 3100

COURSE OBJECTIVES
To gain the knowledge about energy management.
1. To understand the basic concepts in economic analysis in energy management.
2. To understand the basic principles of energy audit.
3. To gain the knowledge about the basic concept of types of Energy Audit
4. To gain and Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. To study about the behaviour changes of PF requirement in motor currents

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   9
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   9
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   9
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   9
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 system- energy efficient transformers.

UNITV   POWER FACTOR IMPROVEMENT, LIGHTING ANDENERGYINSTRUMENTS   9
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 ofPLCs.

TOTAL   45

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
2	W.C.Turner Steve Doty	Energy Management Handbook	John Wiley and Sons, 7th Edition	2013

COURSE OBJECTIVES
1. To understand the basic principles of PLC systems.
2. To gain the knowledge about data handling functions.
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 OUTCOMES
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   9

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   9

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.

UNITIII   REGISTERS ANDPLCFUNCTIONS   9

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   9

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   9

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   45

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
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 Logiccontroller

COURSE OBJECTIVES
1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geo thermal power plants.
6. 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   9
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   9
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   9
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   9
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   9
Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

TOTAL   45

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
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

WEB REFERENCE
1. www.energycentral.com
2. 2. www.catelelectricpowerinfo.com

ELECTRONICS AND COMMUNICATION ENGINEERING

17BEECOE01   **REAL TIMEEMBEDDEDSYSTEMS**   **3 0 0 3100**

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   9

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   9

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   9

Introduction - µ C/OS-II Features - Goals of µ C/OS-II - Hardware and Software Architecture – Kernel Structures: Tasks –Task States – Task Scheduling – Idle Task – Statistics Task – Interrupts Under µ C/OS-II – Clock Tick - µ C/OS-II Initialization. Task Management: Creating Tasks – Task Stacks – Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: Delaying a Task – Resuming a Delayed Task – System Time. Event Control Blocks- Placing a Task in the ECB Wait List – Removing a Task from an ECB waits List.

UNITIV   SEMAPHORE MANAGEMENT ANDMESSAGEPASSING   9

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   9

Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memor y Block – Returning a Memor y Block .Getting Started with µ C/OS-II – Installing µ C/OS-II – Porting µ C/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with µ C/OS-II - µ C/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Anal yze the Multichannel ADC with help of µ C/OS-II

                                                    TOTAL   **45**

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	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   9

Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

UNITII   TELEVISION STANDARDSANDSYSTEMS   9

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   9

AudioDisc–ProcessingoftheAudiosignal–readoutfromtheDisc–Reconstructionoftheaudiosignal–
Video Disc – Video disc formats- recording systems – Playback Systems

UNITIV   TELECOMMUNICATIONSYSTEMS   9

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   9

Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

                                    TOTAL   **45**

TEXT BOOK

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	S.P.Bali	Consumer Electronics	Pearson Education	2005

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   9
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   9
Error – correction learning – memory based learning - hebbian learning-competitive learning-Boltzmann learning- supervised and unsupervised learning-adaptation-statistical learning theory.

UNITIII   PERCEPTION   9
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   9
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   9
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   45

REFERENCES

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	TMH	2008
3	Freeman J.A., Skapura D.M	Neural networks, algorithms, applications, and programming techniques	Addition Wesley	2005
4	Laurene Fausett	Fundamentals of Neural Networks: Architectures, Algorithms, and Applications	Pearson/ Prentice Hall	1997

17BEECOE04   **FUZZY LOGIC AND ITS APPLICATIONS**   **3 0 0 3100**

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   9
Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNITII   THEORY OF APPROXIMATEREASONING   9
Linguistic variables, Fuzzy proportions, Fuzzy if- then statements, inference rules, compositional rule of inference-fuzzy models

UNITIII   FUZZY KNOWLEDGE BASEDCONTROLLERS(FKBC)   9
Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures – Design of Fuzzy Logic Controller

UNITIV   ADAPTIVEFUZZYCONTROL   9
Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNITV   FUZZYBASEDSYSTEMS   9
Simple applications of FKBC -washing machines- traffic regulations -lift control-fuzzy in medical applications-Introduction to ANFIS.

                                                        TOTAL   45

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

BIOTECHNOLOGY

17BTBTOE01   **BIOREACTORDESIGN**   **3 0 0 3100**

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**   **9**

Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

UNITII   **REACTORDESIGN**   **9**

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNITIII   **HEATTRANSFEREQUIPMENTS**   **9**

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulationevaporator.

UNITIV   **MASS TRANSFEREQUIPMENTS**   **9**

Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber

UNITV   **SEPERATIONEQUIPMENTS**   **9**

Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson –walker crystallizer.

                              TOTAL   **45**

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

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Pauline. M. Doran	Bioprocess Engineering Principles	Academic Press	2013

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   9

Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

UNITII   PROCESSINGMETHODS   9

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   9

Size reduction- Fibrous foods, dry foods and liquid foods- Theory and equipments- membrane separation- filtration- equipment andapplication.

UNITIV   FOOD PRESERVATIONBYCOOLING   9

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   45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
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

REFERENCES

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

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 andclassification.
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   9

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   9

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   9

Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNITIV   STRUCTURALBIOINFORMATICS   9

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   9

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.

TOTAL   45

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

REFERENCE

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

17BTBTOE04   FUNDAMENTALS OF NANO BIOTECHNOLOGY   3 0 0 3100

COURSE OBJECTIVES

1. To impart the skills in the field of nano biotechnology and itsapplications.
2. To acquire knowledge in the nano particles and its significance in variousfields.
3. To extend the knowledge in types and application of nano particles insensors.
4. To define the concepts of biomaterials through molecular selfassembly.
5. To equip students with clinical applications of nanodevices.
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   9

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   9

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.

UNITIII   APPLICATIONS   9

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   9

Clinical applications of nanodevices.Artificialneurons.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   9

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.

TOTAL   45

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

REFERENCES

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

AUTOMOBILE ENGINEERING

17BEAEOE01   **AUTOMOBILEENGINEERING**   **3 0 0 3100**

COURSE OBJECTIVES

1. To impart knowledge on the constructional details and principle of operation of various automobile components.
2. To learn the function and working of various components in transmission and drive lines.
3. To study the concept and working of steering and suspension systems in an automobile.
4. To give knowledge on the wheels, tyres and brakes of automobiles.
5. To provide information on the current and future trends in automobiles.
6. Identify and explain the types of steering system.

COURSE OUTCOMES

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

1. Demonstrate the operating principles and constructional details of various automobile components.
2. Explain the function and working of components in transmission and drive lines.
3. Identify and explain the types of steering system.
4. Identify and explain the types of suspension system.
5. Classify and describe the types of wheels, tyres and brakes of automobiles.
6. Discuss the current and future trends in the automobiles.

UNITI   ENGINE AND FUELFEEDSYSTEMS   9
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   9
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   9
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   9
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   9
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   45

TEXT BOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
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

REFERENCES

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

17BEAEOE02   **BASICS OF TWO AND THREE WHEELERS**   **3 0 0 3100**

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   9
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   9
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   9
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   9
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   9
Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

TOTAL   45

TEXTBOOKS

S. No.	Author(s) Name	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

REFERENCES

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

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   9

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   9

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   9

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   9

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 body maintenance, minor and major repairs. Door locks and window glass actuating systemmaintenance.

TOTAL   45

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

17BEAEOE04   **INTRODUCTION TO MODERN VEHICLE TECHNOLOGY**   **3 0 0 3100**

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.

UNITI   TRENDS INPOWERPLANTS   **9**
Hybrid vehicles - Stratified charged / learn burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

UNITII   DRIVERASSISTANCESYSTEMS   **9**
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   **9**
Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passengercomfort.

UNITIV   NOISE&POLLUTION   **9**
Reduction of noise - Internal & external pollution control through alternate fuels/power plants – Catalytic converters and filters for particulate emission.

UNITV   TELEMATICS   **9**
Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition

                                                                        TOTAL   45

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
2	Ronald K.Jurgen	Navigation and Intelligent Transportation Systems –Progress in Technology	Automotive Electronics Series, SAE, USA.	1998

REFERENCES

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

17BECEOE01   **HOUSING, PLANANDMANAGEMENT**   3 0 0 3100

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   9
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   9
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   9
Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNITIV   CONSTRUCTION TECHNIQUES ANDCOST-EFFECTIVEMATERIALS   9
New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNITV   HOUSING FINANCE ANDPROJECTAPPRAISAL   9
Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

                                                                    TOTAL   45

TEXTBOOKS

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

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	CMA	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

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   9

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   9

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   9

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   9

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   9

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

                                                         TOTAL   **45**

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

REFERENCES

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			

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   9

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   9

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

UNITIII   MANAGEMENT   9

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

UNITIV   OPERATION   9

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

UNITV   INVOLVEMENT OFSTAKEHOLDERS   9

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

TOTAL   45

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
2	R.T. Gandhi	Hand book on Irrigation Water Requirement	Water Management Division, Department of Agriculture	1990

REFERENCES

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

17BECEOE04   ADVANCED CONSTRUCTION TECHNOLOGY   3 0 0 3100

COURSEOBJECTIVES

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.

COURSEOUTCOMES

1. Implementation of new technology concepts which are applied in field of Advanced construction.
2. Different methods of construction to successfully achieve the structural design with recommended specifications.
3. Application of scientific and technological principles of planning, analysis, design and management to construction technology.
4. Will gain the Knowledge of construction equipment's, and temporary works required to facilitate the construction process
5. Development to the students for the courses in sector of Advanced construction technology.
6. The new technology of civil Engineering and concepts related Advanced construction technology.

UNITI   MODERNCONSTRUCTIONMETHODS   9
Open Excavation, Shafts and Tunnels- Preparation of foundation, Cofferdams, Caisson, Piled Foundation, Prestressed Concrete Construction, Pre-cast Concrete Construction.

UNITII   CONSTRUCTION METHODS FORSPECIALSTRUCTURES   9
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   9
Construction Equipment used for Earth Moving, Excavating, Drilling, Blasting,Tunneling and hoisting

UNITIV   MODERN CONSTRUCTION EQUIPEMENTS-II   9
Construction Equipment used for Conveying, Hoisting, Dredging, Dewatering Systems, Paving and concreting Plant

UNITV   PRINCIPLES AND PRACTICES OFTEMPORARY STRUCTURES   9
Principles and Practices of Temporary structures, Shoring, and Strutting,Underpinning, Principles and Design of Formwork, Scaffolding, Operation and maintenance of construction equipments

TOTAL   45

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
3	Ataev, S.S	Construction Technology	MIR , Pub	2000

OPEN ELECTIVES
(COURSES OFFERED TO OTHER DEPARTMENTS)

17BEMEOE01 **COMPUTERAIDED DESIGN** **3 0 0 3100**

COURSE OBJECTIVES

1. To apply basic concepts to develop construction (drawing) techniques.
2. To ability to manipulate drawings through editing and plotting techniques.
3. To understand geometric construction and Produce template drawings.
4. To understand and demonstrate dimensioning concepts and techniques.
5. To understand Section and Auxiliary Views.
6. To become familiar with Solid Modelling concepts and techniques.

COURSE OUTCOMES

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

1. Apply basic concepts to develop construction (drawing) techniques.
2. Ability to manipulate drawings through editing and plotting techniques.
3. Understand geometric construction and Produce template drawings.
4. Understand and demonstrate dimensioning concepts and techniques
5. Understand Section and Auxiliary Views
6. Become familiar with Solid Modelling concepts and techniques.

UNITI OVERVIEW OFCADSYSTEMS 9

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

UNITII INTERACTIVE COMPUTER GRAPHICS ANDGRAPHICSTRANSFORMATIONS 9

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives - display transformation in Two- and Three – Dimensional graphics concepts, Graphical input technique, Geometric transpformations, Visual Realism, Computer animation, customizing graphics software.

UNITIII GEOMETRICMODELING 9

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling(ASM)

UNITIV PARAMETRIC DESIGN ANDOBJECTREPRESENTATION 9

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids - manipulations.

UNITV PRODUCT DESIGNANDDEVELOPMENT 9

Automated 2D drafting - basics, mechanical assembly - bill of materials generation. Mass property calculations.

TOTAL 45

TEXTBOOKS

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Vera B Anand	Computer Graphics and Geometric Modeling for Engineers	John Wiley & Sons, New York	2000
2	Radhakrishnan P and Subramanyan S	CAD/CAM/CIM	New Age International Pvt. Ltd	2004

REFERENCES

S. No.	Author(s) Name	Title of the book	Publisher	Year of Publication
1	Radhakrishnan P and Kothandaraman C P	Computer Graphics and Design	Dhanpat Rai & Sons, New Delhi	2002
2	Ibrahim Zeid	CAD/CAM Theory and Practice	McGraw Hill Inc., New York	2003
3	Barry Hawhes	The CAD/CAM Process	Pitman Publishing, London	1998
4	William M Newman and Robert Sproul	Principles of Interactive Computer Graphics	McGraw Hill Inc., New York	1994
5	Sadhu Singh	Computer-Aided Design and Manufacturing	Khanna Publishers, New Delhi	1998
6	Rao S S	Optimisaiton Techniques	Wiley Eastern, New Delhi	2003

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　　　　　　　　　　9
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　　　　　　　　　　　　9
The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes - Distribution management.

UNITIII　　　EVOLUTION OF SUPPLYCHAINMODELS　　　　　　9
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　　　　　　　　　　　9
Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC).

UNITV　　　SCM ORGANISATION ANDINFORMATIONSYSTEM　　　9
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　　　45

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
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

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.
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4. Apply Film- and penetration models for mass and heat transfer.
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6. Solve the given set of equations either analytically or numerically.

UNITI   INTRODUCTION ANDBASICCONCEPTS   9
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   9
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   9
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   9
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   45

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
1. https://laulima.hawaii.edu/portal

| 17BEMEOE04 | **INTRODUCTION TO BIOMECHANICS** | 3 0 0 3100 |

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.

UNIT I   INTRODUCTION   9

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

UNIT II   KEY MECHANICAL CONCEPTS   9

Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

UNIT III   HUMAN ANATOMY AND SOME BASIC TERMINOLOGY   9

Gross (Whole-Body) Modeling - Position and Direction Terminology - Terminology for Common Movements - Skeletal Anatomy - Major Joints - Major Muscle Groups - Anthropometric Data

UNIT IV   ANATOMICAL DESCRIPTION   9

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

UNIT V   MECHANICS OF THE MUSCULOSKELETAL SYSTEM   9

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   45

REFERENCE

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