SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Recognized by UGC & Affiliated to Anna University
Accredited by NBA-AICTE, NAAC-UGC with 'A+' Grade

Saravanampatti, Coimbatore-641035

CURRICULA AND SYLLABI

REGULATION 2016

CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF BIOMEDICAL ENGINEERING

B.E. – BIOMEDICAL ENGINEERING

SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)

REGULATION – 2016
CHOICE BASED CREDIT SYSTEM
SUGGESTED CURRICULUM & SYLLABI
B. E. BIOMEDICAL ENGINEERING

SEMESTER – I

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16EN101	Technical English – I	**HSC**	**3**	3	0	0	3	_
2.	16MA101	Engineering Mathematics – I	**BSC**	**4**	3	1	0	4	_
3.	16PY101	Engineering Physics	**BSC**	**3**	3	0	0	3	_
4.	16CH101	Engineering Chemistry	**BSC**	**3**	3	0	0	3	_
5.	16CS101	Fundamentals of Computing and Programming	**ESC**	**3**	3	0	0	3	_
6.	16GE101	Basic Civil and Mechanical Engineering	**ESC**	**3**	3	0	0	3	_
7.	16GE111/ 16GE113	Career Development Programme I	**EEC**	**3**	1	0	2	2*	_
PRACTICAL									
8.	16CS102	Fundamentals of Computing & Programming Laboratory	**ESC**	**4**	0	0	4	2	16CS101
9.	16PY103	Physics Laboratory	**BSC**	**2**	0	0	2	1	_
10.	16GE102	Engineering Practices Laboratory	**ESC**	**4**	0	0	4	2	_
		TOTAL		**32**	**19**	**1**	**12**	**24+2***	

SEMESTER – II

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16EN102	Technical English – II	**HSC**	**3**	3	0	0	3	16EN101
2.	16MA102	Engineering Mathematics – II	**BSC**	**4**	3	1	0	4	16MA101
3.	16PY102	Physics of Materials	**BSC**	**3**	3	0	0	3	16PY101
4.	16CH102	Environmental Science and Engineering	**BSC**	**3**	3	0	0	3	_
5.	16EE102	Electric Circuit Analysis	**ESC**	**4**	4	0	0	4	16MA102
6.	16ME104	Engineering Graphics	**ESC**	**5**	3	0	2	4	_
7.	16GE112/ 16ME111	Career Development Programme II	**EEC**	**3**	1	0	2	2*	_
PRACTICAL									
8.	16CH103	Chemistry Laboratory	**BSC**	**2**	0	0	2	1	_
9.	16EN103	Communication Skills Laboratory	**HSC**	**4**	0	0	4	2	_
10.	16EE103	Electric Circuit Analysis Laboratory	**ESC**	**2**	0	0	2	1	16EE102
			TOTAL	**33**	**20**	**1**	**12**	**25+2***	

SEMESTER – III

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA201	Transforms and Partial Differential Equations	**BSC**	**4**	3	1	0	4	16MA102
2.	16BM201	Biochemistry and Technology	**PCC**	**3**	3	0	0	3	16CH101
3.	16BM202	Human Anatomy and Physiology	**PCC**	**3**	3	0	0	3	-
4.	16BM203	Biomedical Sensors & Instruments	**PCC**	**3**	3	0	0	3	-
5.	16IT206	Data Structures and Algorithms	**ESC**	**3**	3	0	0	3	16CS101
6.	16EE202	Electronic Devices and Circuits	**PCC**	**3**	3	0	0	3	16EE102
7.	16GE211/ 16GE213	Career Development Programme III	**EEC**	**3**	1	0	2	2*	_
PRACTICAL									
8.	16BM241	Biochemistry and Human Physiology Laboratory	**PCC**	**2**	0	0	2	1	16BM201
9.	16IT207	Data Structures and Algorithms Laboratory	**ESC**	**2**	0	0	2	1	16IT206
10.	16BM242	Electronic Devices and Circuits Laboratory	**PCC**	**4**	0	0	4	2	16EE202
			TOTAL	**30**	**19**	**1**	**10**	**23+2***	

SEMESTER – IV

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA202	Statistics and Numerical Methods	**BSC**	**4**	3	1	0	4	16MA201
2.	16BM220	Pathology and Microbiology	**PCC**	**3**	3	0	0	3	16BM201
3.	16BM221	Analog and Digital ICs	**PCC**	**3**	3	0	0	3	16EE202
4.	16BM222	Medical Physics	**PCC**	**3**	3	0	0	3	16EE202
5.	16BM223	Biomaterials and Artificial Organs	**PCC**	**3**	3	0	0	3	16BM202
6.	16BM224	Bio Control System	**PCC**	**4**	4	0	0	4	16MA102
7.	16GE212/ 16GE214	Career Development Programme IV	**EEC**	**3**	1	0	2	2*	-
PRACTICAL									
8.	16BM243	Pathology and Microbiology Laboratory	**PCC**	**2**	0	0	2	1	16BM220
9.	16BM244	Biomedical Sensors & Instruments Laboratory	**PCC**	**2**	0	0	2	1	16BM203
10.	16BM245	Analog and Digital ICs Laboratory	**PCC**	**4**	0	0	4	2	16BM221
			TOTAL	**33**	**20**	**1**	**12**	**24+2***	

SEMESTER – V

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16GE301	Professional Ethics	**HSC**	**3**	3	0	0	3	_
2.	16BM301	Diagnostic and Therapeutic Equipment I	**PCC**	**3**	3	0	0	3	16BM202
3.	16EI301	PIC Microcontrollers and ARM Processor	**ESC**	**5**	3	0	1	4	16EE202
4.	16CS451	Object Oriented Programming using C++	**ESC**	**3**	3	0	0	3	16CS101 16IT206
5.		Professional Elective I	**PEC**	**3**	3	0	0	3	
6.		Open Elective I	**OEC**	**3**	3	0	0	3**	
7.	16BM311/ 16GE313	Career Development Programme V (Professional)	**EEC**	**3**	1	0	2	2*	-
PRACTICAL									
8.	16BM341	Diagnostic and Therapeutic Equipment I Laboratory	**PCC**	**2**	0	0	2	1	16BM301
9.	16EI320	PIC Microcontrollers and ARM Processor Laboratory	**ESC**	**2**	0	0	2	1	-
10.	16CS452	Object Oriented Programming using C++ Laboratory	**ESC**	**4**	0	0	4	2	16CS451
			TOTAL	**31**	**17**	**0**	**13**	**23+2***	

SEMESTER – VI

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16BM321	Radiological Equipment	**PCC**	**3**	3	0	0	3	16BM203
2.	16BM322	Diagnostic and Therapeutic Equipment II	**PCC**	**3**	3	0	0	3	16BM301
3.	16BM323	Biomedical Signal Processing	**PCC**	**5**	3	0	2	4	16MA102
4.	16BM324	Biomedical Image Processing	**PCC**	**5**	3	0	2	4	16MA102
5.		Professional Elective II	**PEC**	**3**	3	0	0	3	-
6.		Open Elective II	**OEC**	**3**	3	0	0	3**	-
7.	16GE312/ 16GE314	Career Development Programme VI	**EEC**	**3**	1	0	2	2*	-
PRACTICAL									
8.	16BM342	Diagnostic and Therapeutic Equipment II Laboratory	**PCC**	**2**	0	0	2	1	16BM341
9.	16BM343	Biomedical Signal Processing Laboratory	**PCC**	**2**	0	0	2	1	16MA201
10.	16BM344	Biomedical Image Processing Laboratory	**PCC**	**2**	0	0	2	1	16MA201
			TOTAL	**31**	**19**	**0**	**12**	**23+2***	

SEMESTER – VII

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16GE302	Engineering Economics and Cost Analysis	**HSC**	**3**	3	0	0	3	-
2.	16BM402	Virtual Instrumentation design for Medical System	**EEC**	**3**	3	0	0	3	-
3.		Professional Elective – III	**PEC**	**3**	3	0	0	3	-
4.		Professional Elective – IV	**PEC**	**3**	3	0	0	3	-
5.		Professional Elective – V	**PEC**	**3**	3	0	0	3	-
6.		Open Elective – III	**OEC**	**3**	3	0	0	3**	-
PRACTICAL									
7.	16BM411	Virtual Instrumentation design for Medical System Laboratory	**EEC**	**2**	0	0	2	1	16BM402
8.	16BM412	Hospital Training	**EEC**	**4**	0	0	4	2	16BM322 16BM342
9.	16BM413	Project Phase – I	**EEC**	**4**	0	0	4	2	-
			TOTAL	**28**	**18**	**0**	**10**	**23**	

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.		Professional Elective – VI	PE	3	3	0	0	3	-
2.		Professional Elective – VII	PE	3	3	0	0	3	-
PRACTICAL									
3.	16BM414	Project Phase – II	EEC	20	0	0	20	10	-
			TOTAL	**26**	**6**	**0**	**20**	**16**	

TOTAL NO. OF CREDITS: 181

*Not included in the calculation of CGPA

**Courses from the curriculum of other UG Programmes

HUMANITIES AND SOCIAL SCIENCES COURSES (HSC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16EN101	Technical English – I	3	3	0	0	3	_
2.	16EN102	Technical English – II	3	3	0	0	3	16EN101
3.	16GE301	Professional Ethics	3	3	0	0	3	_
4.	16GE302	Engineering Economics and Cost Analysis	3	3	0	0	3	-
5.	16EN103	Communication Skills Laboratory	4	0	0	4	2	-

BASIC SCIENCES COURSES (BSC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16MA101	Engineering Mathematics I	4	3	1	0	4	-
2.	16PY101	Engineering Physics	3	3	0	0	3	-
3.	16CH101	Engineering Chemistry	3	3	0	0	3	-
4.	16MA102	Engineering Mathematics II	4	3	1	0	4	16MA101
5.	16PY102	Physics of Materials	3	3	0	0	3	16PY101
6.	16CH102	Environmental Science and Engineering	3	3	0	0	3	-
7.	16MA201	Transforms and Partial Differential Equations	4	3	1	0	4	16MA102
8.	16MA202	Statistics and Numerical Methods	4	3	1	0	4	16MA201
9.	16PY103	Physics Laboratory	2	0	0	2	1	-
10.	16CH103	Chemistry Laboratory	2	0	0	2	1	-

ENGINEERING SCIENCES COURSES (ESC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CS101	Fundamentals of Computing and Programming	3	3	0	0	3	-
2.	16GE101	Basic Civil and Mechanical Engineering	3	3	0	0	3	-
3.	16EE102	Electric Circuit Analysis	4	4	0	0	4	16MA102
4.	16ME104	Engineering Graphics	5	3	0	2	4	-
5.	16IT206	Data Structures and Algorithms	3	3	0	0	3	16CS101
6.	16EI301	PIC Microcontrollers and ARM Processor	5	3	0	1	4	16EE202
7.	16CS451	Object Oriented Programming using C++	3	3	0	0	3	16CS101 16IT206
8.	16CS102	Fundamentals of Computing & Programming Laboratory	4	0	0	4	2	16CS101
9.	16GE102	Engineering Practices Laboratory	4	0	0	4	2	-
10.	16EE103	Electric Circuit Analysis Laboratory	2	0	0	2	1	16EE102
11.	16IT207	Data Structures and Algorithms Laboratory	2	0	0	2	1	16IT206
12.	16EI320	PIC Microcontrollers and ARM Processor Laboratory	2	0	0	2	1	-
13.	16CS452	Object Oriented Programming using C++ Laboratory	4	0	0	4	2	16CS451

PROFESSIONAL CORE COURSES (PCC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM201	Biochemistry and Technology	3	3	0	0	3	16CH101
2.	16BM202	Human Anatomy and Physiology	3	3	0	0	3	-
3.	16BM203	Biomedical Sensors & Instruments	3	3	0	0	3	-
4.	16EE202	Electronic Devices and Circuits	3	3	0	0	3	16EE102
5.	16BM220	Pathology and Microbiology	3	3	0	0	3	16BM201
6.	16BM221	Analog and Digital ICs	3	3	0	0	3	16EE202
7.	16BM222	Medical Physics	3	3	0	0	3	16EE202
8.	16BM223	Biomaterials and Artificial Organs	3	3	0	0	3	16BM202
9.	16BM224	Bio Control System	4	4	0	0	4	16MA102
10.	16BM301	Diagnostic and Therapeutic Equipment – I	3	3	0	0	3	16BM202
11.	16BM321	Radiological Equipment	3	3	0	0	3	16BM203
12.	16BM322	Diagnostic and Therapeutic Equipment II	3	3	0	0	3	16BM301
13.	16BM323	Biomedical Signal Processing	5	3	0	2	4	16MA102

14.	16BM324	Biomedical Image Processing	5	3	0	2	4	16MA102
15.	16BM241	Biochemistry and Human Physiology Laboratory	2	0	0	2	1	16BM201
16.	16BM242	Electronic Devices and Circuits Laboratory	4	0	0	4	2	16EE202
17.	16BM243	Pathology and Microbiology Laboratory	2	0	0	2	1	16BM220
18.	16BM244	Biomedical Sensors & Instruments Laboratory	4	0	0	4	1	16BM203
19.	16BM245	Analog and Digital ICs Laboratory	4	0	0	4	2	16BM221
20.	16BM341	Diagnostic and Therapeutic Equipment I Laboratory	2	0	0	2	1	16BM301
21.	16BM342	Diagnostic and Therapeutic Equipment II Laboratory	2	0	0	2	1	16BM341
22.	16BM343	Biomedical Signal Processing Laboratory	2	0	0	2	1	16MA201
23.	16BM344	Biomedical Image Processing Laboratory	2	0	0	2	1	16MA201

PROFESSIONAL ELECTIVE COURSES (PEC)

PROFESSIONAL ELECTIVE – I

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM421	Body Area Network	3	3	0	0	3	–
2.	16BM425	Ultrasound in Medicine	3	3	0	0	3	–
3.	16IT420	Social Network Analysis	3	3	0	0	3	–
4.	16EE420	Special Electrical Machines	3	3	0	0	3	–

PROFESSIONAL ELECTIVE – II

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM422	Wearable Systems	3	3	0	0	3	–
2.	16BM423	Physiological Modeling	3	3	0	0	3	–
3.	16BM424	Tele- health Technology	3	3	0	0	3	–
4.	16MC401	Robotics and Machine Vision System	3	3	0	0	3	–

PROFESSIONAL ELECTIVE – III

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16GE303	Total Quality Management	3	3	0	0	3	_
2.	16GE304	Principles of Management	3	3	0	0	3	_
3.	16GE305	Intellectual Property Rights	3	3	0	0	3	_
4.	16GE306	HRM and Entrepreneurship	3	3	0	0	3	_

PROFESSIONAL ELECTIVE – IV

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM460	Foundation skills in Integrated Product Development	3	3	0	0	3	–
2.	16BM461	Fibre Optic and Lasers in Medicine	3	3	0	0	3	–
3.	16BM462	BioMEMS	3	3	0	0	3	–
4.	16BM463	Artificial Intelligence and Expert System	3	3	0	0	3	–

PROFESSIONAL ELECTIVE – V

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM464	Neural Engineering	3	3	0	0	3	–
2.	16BM465	Biometrics	3	3	0	0	3	–
3.	16EI452	Neural Networks and Fuzzy Logic	3	3	0	0	3	–
4.	16BM466	Biofluids and Dynamics	3	3	0	0	3	–

PROFESSIONAL ELECTIVE – VI

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM467	Medical Informatics	3	3	0	0	3	–
2.	16BM468	Assist Devices	3	3	0	0	3	
3.	16BM469	Rehabilitation Engineering	3	3	0	0	3	–
4.	16BM470	Speech Processing	3	3	0	0	3	–

PROFESSIONAL ELECTIVE – VII

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16BM471	Medical Radiation Safety Engineering	3	3	0	0	3	–
2.	16BM472	Biostatistics	3	3	0	0	3	–
3.	16BM473	ICU and Operation Theatre Equipment	3	3	0	0	3	–
4.	16BM474	Clinical Engineering	3	3	0	0	3	–

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16GE111/ 16GE113	Career Development Programme I	3	1	0	2	2*	–
2.	16GE112/ 16ME111	Career Development Programme II	3	1	0	2	2*	–
3.	16GE211/ 16GE213	Career Development Programme III	3	1	0	2	2*	–
4.	16GE212/ 16GE214	Career Development Programme IV	3	1	0	2	2*	–
5.	16BM311/ 16GE313	Career Development Programme V (Professional)	3	1	0	2	2*	–
6.	16GE312/ 16GE314	Career Development Programme VI	3	1	0	2	2*	–
7.	16BM402	Virtual Instrumentation design for Medical System	3	3	0	0	3	–
8.	16BM411	Virtual Instrumentation design for Medical System Laboratory	2	0	0	2	1	16BM402
9.	16BM412	Hospital Training	4	0	0	4	2	16BM322 16BM342
10.	16BM413	Project Phase – I	4	0	0	4	2	-
11.	16BM414	Project Phase – II	20	0	0	20	10	-

OPEN ELECTIVE OFFERED TO OTHER PROGRAMMES

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C	PRE-REQUISITES
1	16BMOE1	Biomedical LASER and its Applications	3	0	0	3	–
2	16BMOE2	Robotics and Automation In Medicine	3	0	0	3	–
3	16BMOE3	Troubleshooting of Medical Instruments	3	0	0	3	–
4	16BMOE4	Research Methodologies and Bio Ethics	3	0	0	3	–

ONE CREDIT COURSES

S.NO	COURSE CODE	COURSE TITLE
1	16BMOC1	Medical Textiles
2	16BMOC2	Introduction to Nanotechnology
3	16BMOC3	Professional Values and Bioethics
4	16BMOC4	Introduction to MEMS
5	16BMOC5	ISO 9001 Standards
6	16BMOC6	IoT in healthcare
7	16BMOC7	Hospital Furniture

SUMMARY

S. No.	SUBJECT AREA	Credits Per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	**HSC**	3	5	-	-	3	-	3	-	14
2	**BSC**	11	11	4	4	-	-	-	-	30
3	**ESC**	10	9	4	-	10	-	-	-	33
4	**PCC**	-	-	15	20	4	17	-	-	56
5	**PEC**	-	-	-	-	3	3	9	6	21
6	**OEC**	-	-	-	-	3	3	3	-	9
7	**EEC**	-	-	-	-	-	-	8	10	18
	TOTAL	**24**	**25**	**23**	**24**	**23**	**23**	**23**	**16**	**181**
8.	**Non-Credit / Mandatory**	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**

16EN101   **TECHNICAL ENGLISH I**   **L T P C**

(Common to all B.E. / B. Tech. Courses)   **3 0 0 3**

UNIT I   9
General Vocabulary (Word–formation - prefixes & suffixes, root words) – Tenses – Adjectives forms – Adverb forms - Compound nouns - Abbreviations and Acronyms –Techniques of reading – Autobiographical writing.

UNIT II   9
Active and Passive voice – Impersonal passive voice - Articles - Prepositions –Spelling and Punctuation –'WH' Question forms – Yes / No question form – Reading & note-making – Paragraph writing - comparison and contrast.

UNIT III   9
Uses of Modal auxiliaries – Instructions– Definitions - Single line & Extended - Reading and understanding through Context –Transfer of information – bar chart, flowchart- Crafting advertisements.

UNIT IV   9
Concord (subject & verb agreement) – Cause and effect expressions – One word substitution - Letter writing-letter to the editor & permission letter (for Industrial Visit & In-plant training) - Paragraph writing-descriptive.

UNIT V   9
Empty verbs - 'If' conditionals – Gerund & Infinitive - Formal Letter writing – invitation, accepting & declining - Paragraph writing – analytical.

L :45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
 1 Dhanavel.S.P. English and Communication Skills for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
 2. Gunasekaran.S , ' Technical English I' Third Edition, Vishnu Prints Media, Chennai, 2016.

REFERENCES
 1 Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011. .
 2 Regional Institute of English. English for Engineers, Cambridge University Press, New Delhi, 2006.
 3 Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
 4 Department of English, Anna University, Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.
 5 Mitra K. Barun, "Effective Technical Communication – A Guide for Scientists and Engineers", Oxford University Press, New Delhi, 2006.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Employ their active and passive vocabulary and construct basic sentence structures.
CO2 Become active readers who appreciate ambiguity and complexity, and who can articulate their own interpretations.
CO3 Write effectively and flawlessly avoiding grammatical errors for a variety of professional and social settings.
CO4 Demonstrate the usage of language effectively, creatively and successfully in both general and specific contexts.
CO5 Exhibit letter writing skills for effective communication both in formal and informal situations.

16MA101   **ENGINEERING MATHEMATICS- I**   **L   T   P   C**

(Common to All B.E. / B. Tech. Courses)   **3   1   0   4**

UNIT I   MATRICES   **9+3**
Characteristic equation – Eigen values and Eigen vectors of a real matrix –Properties–Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation – Cayley– Hamilton theorem (excluding proof).

UNIT II   THREE DIMENSIONAL ANALYTICAL GEOMETRY   **9+3**
Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III   DIFFERENTIAL CALCULUS   **9+3**
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

UNIT IV   FUNCTIONS OF SEVERAL VARIABLES   **9+3**
Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Jacobians – Taylor's expansion– Maxima and Minima – Method of Lagrangian multipliers.

UNIT V   DIFFERENTIAL EQUATIONS OF HIGHER ORDER   **9+3**
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear differential equations.

L :45   T:15   P: 0   Total: 60 PERIODS

TEXT BOOKS
 1   Bali, N. P. and Manish Goyal, "Text book of Engineering Mathematics", 4th Edition, University Science Press, 2014.
 2. Grewal, B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.

REFERENCES
 1   Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2014.
 2   Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Engineering Mathematics", Volume I., S. Chand & Co., New Delhi, 2012.
 3   Veerarajan, T., "Engineering Mathematics for First Year", Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2014.
 4   Kreyszig, E., "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons, Inc, Singapore, 2008.
 5   Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education Ltd., 2013.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Know Eigen values and Eigen vectors and its role in the system of equations.
CO2   Explore the knowledge to solving problems involving Sphere, Cone and Cylinder.
CO3   Discover the radius, centre and circle of curvature of any curves.
CO4   Identify the maximum and minimum values of surfaces.
CO5   Solve the ordinary differential equations of certain types.

16PY101	ENGINEERING PHYSICS	L	T	P	C
	(Common to All B.E. / B. Tech. Courses)	3	0	0	3

UNIT I   CRYSTAL PHYSICS   9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)

UNIT II   PROPERTIES OF MATTER AND THERMAL PHYSICS   9

Elasticity- Hooke's law - Relationship between three moduli of elasticity– stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow -Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III   QUANTUM PHYSICS   9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment- Physical significance of wave function -Schrödinger's wave equation – Time independent and time dependent equations– Particle in a one dimensional box –Electron microscope- Scanning electron microscope

UNIT IV   ACOUSTICS AND ULTRASONICS   9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of Ultrasonic's by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications – Sonogram.

UNIT V   PHOTONICS AND FIBRE OPTICS   9

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO , Semiconductor lasers –applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Losses in optical fibre- attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram)

L :45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
 1   Naresh Kumar. P and Balasubramanian. V, Engineering Physics I, Gems Publishers, 2015
 2   Avadhanalu.M.N   and Kshirsagar.P.G, A textbook of Engineering Physics, S. Chand & company Ltd, 2013.

REFERENCES
 1   Searls and Zemansky, University Physics, 2009.
 2   Gaur R.K. And Gupta S.L, Engineering Physics, Dhanpat Rai publishers, 2009.
 3   Palanisamy P.K, Engineering Physics, SCITECH Publications, 2011.
 4   Rajendran.V, Engineering Physics, Tata Mc graw-Hill Publishing Company Limited, New Delhi.2009.
 5   Dr.G.Senthil kumar, Engineering Physics-I, VRB Publishers Pvt.Ltd. Chennai. (2013).

COURSE OUTCOMES :

At the end of the course student should be able to

CO1	Understand the properties of the crystalline materials.
CO2	Analyze the elastic and thermal properties of the materials.
CO3	Understand the basics of quantum mechanics.
CO4	Identify the applications of acoustics and ultrasonic waves.
CO5	Understand the basics and applications of photonics and fibre optics technology.

16CH101   **ENGINEERING CHEMISTRY**   **L   T   P   C**
                 (Common to All B.E. / B. Tech. Courses)   **3   0   0   3**

UNIT I   ELECTRO CHEMISTRY   9
Electrochemical - EMF – Electrode potential – Nernst equation — problem – electrochemical series – significance– reference electrodes –Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH and Fuel cells – hydrogen – oxygen fuel cell – batteries – Primary — Leclanche cell – secondary – Lead – acid battery – Lithium batteries ($Li-TiS_2$ and Li - S battery).

UNIT II   CORROSION AND ITS CONTROL   9
Chemical corrosion – oxidation corrosion – mechanism – Pilling – Bed worth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Gold plating).

UNIT III   SPECTROSCOPY   9
Beer-Lambert's law – problem – UV-visible spectroscopy and IR spectroscopy (principle –instrumentation) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principle – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy

UNIT IV   SURFACE CHEMISTRY & WATER TECHNOLOGY   9
Adsorption – types – adsorption of gases on solids – adsorption isotherms – Frendlich and Langmuir isotherms – – role of adsorbents in ion-exchange adsorption (Demineralization only). Water – hardness – problems – Domestic water treatment – disinfection methods (Chlorination, Ozonation, UV treatment) – break point chlorination – salinity – desalination by reverse osmosis

UNIT V   ENGINEERING MATERIALS   9
Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrication - properties – viscosity index, flash and fire points, cloud and pour points, oiliness) – solid lubricants – graphite and molybdenum sulphide.

L :45   T: 0   P: 0   Total :45 PERIODS

TEXT BOOKS
1   M.Manjuladevi, R.Anitha "Engineering Chemistry" Gem Pub. Coimbatore. 2013.
2.   P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi 2008.
REFERENCES
1   B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2009).
2   R. Sivakumar and N Sivakumar, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd. New Delhi.2009.
3   Dr.Gourkrishna and Dasmohapatra, "Engineering Chemistry" Vikas Pub. House Pvt.Ltd. 2011.
4   O.Gpalanna, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2009.
5   B.R.Puri,L.R.Sharma&M.S.Pathania,"Principles of Physical Chemistry" Vishalpublishing Co. Jalandhar, Punjab. 2013.

COURSE OUTCOMES :
At the end of the course student should be able to:
CO1   Assemble a battery and illustrate the phenomenon of production of electric current
CO2   Know the technical information about corrosion, corrosion control by galvanization and electroplating
CO3   Gain knowledge on the principles and instrumentation of spectroscopic techniques
CO4   Apply the theory of adsorption in real life situations
CO5   Acquire sound knowledge on different types of Engineering materials

16CS101   **FUNDAMENTALS OF COMPUTING AND**   **L**   **T**   **P**   **C**
                             PROGRAMMING
                        (Common to All B.E. / B. Tech.)   **3**   **0**   **0**   **3**

UNIT I   INTRODUCTION TO COMPUTERS   8

Introduction – Characteristics of Computers –Computer Generations – Classification of Computers – Basic Computer organization – Number Systems- Algorithm –Pseudo code –Flow Chart- Computer Software –Types of Software– Internet Terminology

UNIT II   C PROGRAMMING BASICS   10

Introduction to 'C' programming –fundamental Rules–structure of a 'C' program –compilation and linking processes –Constants, Variables, keywords, Identifier, Delimiters –Declaring and Initializing variables–Data Types –Operators and Expressions–Managing Input and Output operations –Decision Making and Branching –Looping statements –solving simple scientific and statistical problems.

UNIT III   ARRAYS AND STRINGS   10

Arrays – Characteristics, Initialization – Declaration – One dimensional and two dimensional arrays. String- String operations – String Arrays. Simple programs-sorting-searching –matrix operations (Addition, subtraction and Multiplication).

UNIT IV   FUNCTIONS AND POINTERS   9

Function –definition of function – User-defined Functions - Declaration of function – Call by reference – Call by value –Recursion –Pointers -Definition –Initialization –Pointers arithmetic –Pointers and arrays-Example Problems.

UNIT V   STRUCTURES AND UNIONS   8

Defining Structures and Unions–Structure declaration –need for structure data type - Structure within a structure- Union -Programs using structures and Unions- Pre-processor directives.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. E.Balagurusamy, "Fundamentals of Computing and Computer Programming", Tata McGraw-Hill Publishing Company Limited, (2011).
2. Ashok.N.Kamthane," Computer Programming", Pearson Education (India) (2010).

REFERENCES
1. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH Publications, (2006).
2. Stephan G kochan, "Programming in C" Pearson Education (2010).
3. P.Sudharson, "Computer Programming", RBA Publications (2008).
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Distinguish the differences among the various generation and classification of computers and solve problems in number system
CO2 Understand the basic concepts of C programming and write programs using various control statements
CO3 Implement programs using arrays and apply the concepts to solve basic problems
CO4 Write C programs to solve problems using functions and pointers
CO5 Understand the concepts structures and unions and apply them

16GE101   **BASIC CIVIL AND MECHANICAL ENGINEERING**   L   T   P   C

(Common to all B.E. / B. Tech. Courses)   **3   0   0   3**

UNIT I   CIVIL ENGINEERING MATERIALS AND SURVEYING   9

Introduction: Civil engineering-scope of civil engineering-building materials- Brick, stone, cement, concrete, properties-uses Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

UNIT II   BUILDING COMPONENTS   9

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring plastering.

UNIT III   POWER PLANT ENGINEERING   9

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – working principle of Pumps - Single, Double acting and Centrifugal Pumps.

UNIT IV   IC ENGINES, REFRIGERATION AND AIR CONDITIONING   9
**   SYSTEM**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles –Principle of Vapour compression system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

UNIT V   BASIC MANUFACTURING PROCESSES   9

Foundry: Introduction- patterns – Moulding – casting - cupola furnace.

Welding: Introduction-Classification – ARC, TIG, MIG welding, Gas welding, soldering and brazing.

Machining process: Introduction-Classification – lathe and drilling machines.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1 Naveen Sait.A., Soundararajan.R., "Basic Civil and Mechanical Engineering", RP Publications, Coimbatore, [2016].
2. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, (2016).

REFERENCES
1 Rangwala,S.C., " Engineering Materials" , Charotar Publishing House, Anand, 2014.
2 Surendra Singh, "Building Materials" Vikas Publishing Company, New Delhi, 2015.
3 Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", AnuradhaPublishers, Kumbakonam, (2016).
4 Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2016).
5 Rao, P N, Manufacturing Technology: Foundry, Forming And Welding", Tata McGraw-Hill, New Delhi, 2015.

COURSE OUTCOMES

At the end of the course student should be able to:
CO1 Describe about building materials & surveying equipments in real time.
CO2 Outline the basic building components and requirements of good foundation.
CO3 Identify the possibilities of energy conversion from various energy sources using power plants.
CO4 Summarize the working principles of various Mechanical systems used in day to day applications.
CO5 Apply the various basic Manufacturing processes to make products.

16GE111	**CAREER DEVELOPMENT PROGRAMME - I**	**L**	**T**	**P**	**C**
	(Common to All B.E. / B. Tech. Courses)	**1**	**0**	**2**	**2***

UNIT I   TRAINING FUNDAMENTALS   3+6

Goal Settings – Insights into pre-placement requisites – SWOT Analysis – LSRW Skills.

UNIT II   LINGUISTIC SKILLS I   3+6

Parts of Speech – Noun, Verb, Participle, Articles, Pronoun, Preposition, Adverb, Conjunction –
Logical sequence of words –Tense & Voice – Comparison – Comprehension – comprehend and understand a paragraph

UNIT III   QUANTITATIVE ABILITY I   3+6

Number theory – Percentage – Profit, loss and discount – Simple and compound interest.

UNIT IV   QUANTITATIVE ABILITY II   3+6

Ratio & Proportions – Partnership – Problems on Average & Ages – Clocks – Time sequence test.

UNIT V   COMMUNICATION SKILLS   3+6

Impromptu Speech – Group Discussion – Questioning Technique.

L:15   T: 0   P:30   Total: 45 PERIODS

TEXT BOOKS
 1   John Eastwood, "Oxford Practice Grammar", Oxford, 2006.
 2.   Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications, 2010.

REFERENCES
 1   Barun K. Mithra, 2016, "Personality Development & Soft Skills", Oxford.
 2   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication, 2012.
 3   R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited, 2016.
 4   Arun Sharma - Quantitative Aptitude for CAT.
 5   Dr. Rishipal and Dr. Jyoti Sheoran "Business Communication", SPD Publisher, 2014.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Set their career goals through SWOT analysis.
CO2   Form sentences through logical sequence of words and understand passage through Comprehension
CO3   Apply the shortcut methods in quantitative aptitude.
CO4   Solve application orientated concepts in quantitative aptitude.
CO5   Communicate well and familiarize with the questioning techniques.

16GE113   **CAREER DEVELOPMENT PROGRAMME - I**   **L   T   P   C**

(Common to All B.E. / B. Tech. Courses)   **1   0   2   2***

UNIT I   TRAINING FUNDAMENTALS   8

Goal Settings – Insights into pre-placement requisites – SWOT Analysis – LSRW Skills.

UNIT II   LINGUISTIC SKILLS I   12

Parts of Speech – Error spotting, Logical sequence of words, Tense & Voice, Comparison, Paragraph completion.

UNIT III   LINGUISTIC SKILLS II   8

Comprehend – comprehend and understand a paragraph, Sentences - Simple, Compound & Complex sentences, Jumbled sentence, Idioms & Phrases.

UNIT IV   PERSONALITY DEVELOPMENT   9

Personality, Presentation Skills – stages, selection of topic, content & aids, Minutes of meeting, Public speaking.

UNIT V   COMMUNICATION SKILLS   8

Impromptu Speech – Group Discussion – Questioning Technique.

L:15   T:0   P: 30   Total: 45 PERIODS

TEXT BOOKS
 1   John Eastwood, "Oxford Practice Grammar", Oxford.
 2.   Barun K. Mithra, "Personality Development & Soft Skills", Oxford.

REFERENCES
 1   Barun K. Mithra, 2016, "Personality Development & Soft Skills", Oxford.
 2   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication, 2012.
 3   R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited, 2016.
 4   Arun Sharma - Quantitative Aptitude for CAT.
 5   Dr. Rishipal and Dr. Jyoti Sheoran "Business Communication", SPD Publisher, 2014.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Understand language structures and functioning of the language.
CO2   Analyse the parts of speech.
CO3   Demonstrate knowledge of personal beliefs and values.
CO4   Understand language attitudes.
CO5   Raise the basic language skills.

16CS102	FUNDAMENTALS OF COMPUTING AND PROGRAMMING LABORATORY	L	T	P	C
	(Common to All B.E. / B. Tech.)	0	0	4	2

LIST OF EXPERIMENTS

A) Word Processing
1. Document creation, Text manipulation with Scientific notations
2. Table creation, Table formatting and Conversion
3. Mail merge and Letter preparation
4. Drawing Flow Chart

B) Spread Sheet
1. Chart - Line, XY, Bar and Pie.
2. Formula - formula editor.
3. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
4. Sorting and Import / Export features.

C) Simple C Programming
1. Data types, Expression Evaluation, Condition Statements.
2. Arrays , Looping Statement
3. Functions , Pointers
4. Structures and Unions

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

    Hardware
- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
- Printers – 3 Nos.

    Software
- OS – Windows / UNIX Clone
- Application Package – Office suite
- Compiler – C

L : 0   T: 0   P: 60   Total: 60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Create a document, insert formulas and pictures and prepare letters using MS office

CO2   Create tables and charts, use formula in calculations and protect worksheets in MS Excel

CO3   Write simple programs using basic C Concepts

CO4   Write C programs using concepts in control statements

CO5   Write C programs to solve problems using Arrays, Functions, Pointers, Unions, and Structures

PHYSICS LABORATORY   **L**   **T**   **P**   **C**

(Common to All B.E. / B. Tech. Courses)   **0**   **0**   **2**   **1**

LIST OF EXPERIMENTS

1. Determination of wavelength of mercury spectrum – Spectrometer grating
2. Determination of Young's modulus of the material – uniform bending.
3. Determination of viscosity of liquid – Poiseuille's method.
   - (a)   Particle size determination using Diode Laser.
   - (b)   Determination of Laser parameters – Wavelength.
4. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
5. Determination of thickness of a thin wire – Air wedge method.
6. Determination of dispersive power of a prism using spectrometer.
7. Determination of Young's modulus of the material – non uniform bending.
8. Torsional Pendulum - determination of rigidity modulus of wire and moment of inertia of disc.
9. Determination of Band gap of semiconductor material.

MAJOR EQUIPMENTS / SOFTWARE REQUIRED
- Spectrometer
- Young's modulus apparatus
- Poiseuille's method apparatus
- Diode Laser
- Ultrasonic Interferrometer
- Air Wedge apparatus
- Torisional Pendulum Apparatus
- Bandgap determination kit

            L: 0   **T: 0**   **P: 30**   **Total: 30 PERIODS**

COURSE OUTCOMES
At the end of the course student should be able to:

CO1   Experiment the concept of stress, strain for the given material.

CO2   Utilize the concept of interference and diffraction in optical measuring instruments.

CO3   Experiment the concept of diffraction in determining the wavelength, velocity of ultrasonic waves.

CO4   Grasp the knowledge of dependency of viscosity of a liquid on its density and velocity of liquid motion.

CO5   Apply the concept of temperature dependence of resistance of a semiconducting

16GE102 **ENGINEERING PRACTICES LABORATORY** L T P C

                                                        0 0 4 2

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL) (30)

CIVIL ENGINEERING (12)

1. Study of plumbing tools and Components
2. Preparation of threads in pipes
3. Preparation of single and multi tap connections for domestic
4. Study of carpentry tools and its applications
5. Preparation of Cross Lap and Dove Tail Joints.

MECHANICAL ENGINEERING (18)

1. Study of different types of Welding and its applications
2. Preparation of Butt, Lap and Tee joints
3. Study of sheet metal and its applications
4. Preparation of Rectangular, Square Trays and Funnel
5. Demonstration of Lathe and Drilling Operations
6. Demonstration of Smithy and Foundry tools.

GROUP B (ELECTRICAL AND ELECTRONICS) (30)

ELECTRICAL ENGINEERING PRACTICE (18)

1. Residential house wiring using switches, fuse, miniature circuit breaker, indicator, Lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair-case wiring.
4. Measurement of electrical quantities –voltage, current, power & power factor in RLC Circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of insulation resistance to earth of electrical equipment.
7. Measurement of single and three phase voltages.
8. Study of Iron Box, Emergency Lamp and Fan.

ELECTRONICS ENGINEERING PRACTICE (12)

1. Study of Electronic components and equipments –Resistor, colour coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Verification of logic gates: AND, OR, Ex-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice –Components Devices and Circuits Using general purpose PCB.
5. Characteristics of a PN Junction diode

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

CIVIL

1   Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.
2   Carpentry vice(fitted to workbench)
3   Standard wood working tools
4   Models of industrial trusses, door joints, furniture joints
5   Power Tools:
    (a)Rotary Hammer
    (b)Demolition Hammer
    (c)Circular Saw
    (d)Planer
    (e)Hand Drilling Machine
    (f)Jigsaw

MECHANICAL

1   Arc welding transformer with cables and holders
2   Welding booth with exhaust facility
3   Welding accessories like welding shield, chipping hammer, wire brush, etc.
4   Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.
5   Centre lathe
6   Hearth furnace, anvil and smithy tools
7   Moulding table, foundry tools
8   Power Tool: Angle Grinder
9   Study-purpose items: centrifugal pump, air-conditioner

ELECTRICAL

1   Assorted electrical components for house wiring
2   Electrical measuring instruments
3   Study purpose items: Iron box, fan and regulator, emergency lamp
4   Megger (250V/500V)
5   Power Tools:
    (a) Range Finder
    (b) Digital Live-wire detector

ELECTRONICS

1   Soldering guns
2   Assorted electronic components for making circuits
3   Small PCBs
4   Multi Meters
5   Study purpose items: Telephone, FM radio, low-voltage power supply
6   Bread Board
7   CRO

L : 0   T: 0   P: 60   Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Demonstrate plumbing system and Carpentry for the required applications.

CO2   Relate the basic machining operations with engineering problems.

CO3   Apply different types of Welding processes and Sheet metal processes for the Industrial applications

CO4   Illustrate Residential House wiring and simple wiring circuits.

CO5   Employ knowledge on measuring electrical quantities and usage of energy meters.

16EN102   **TECHNICAL ENGLISH II**   **L   T   P   C**

(Common to all B.E. / B. Tech. Courses)   **3   0   0   3**

UNIT I   9
Technical Vocabulary – meanings in context – Sentence pattern - Process description - Sequencing words - Uses of Pronouns - Paragraph writing – narrative.

UNIT II   9
Numerical adjective - Phrasal verbs - Phrases / Structures indicating use / purpose – Introduction to communication & Barriers to communication - Non-verbal communication – Different grammatical forms of the same word.

UNIT III   9
Stress and Intonation – Word stress & Sentence stress – Formal Letter writing- quotations, clarification, placing orders, complaint letter – Writing – Using connectives (discourse makers) - Recommendations -Report writing – types of report, report format, recommendations/suggestions- (Fire Accident & Road Accident).

UNIT IV   9
Direct & Indirect speech – Argumentative paragraphs – Letter of application – content, format (CV / Resume) – Checklist– E-mail communication – Blog writing.

UNIT V   9
Auxiliary verbs - Preparing Agenda, Notices and Minutes – Proposal writing – project/business proposal- Technical essay – Conversational skills – four types of speeches – extempore, manuscript, impromptu, memorized.

L :45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
 1   Gunasekaran.S , ' Technical English II' Third Edition, Vishnu Prints Media, Chennai, 2016.
 2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011.

REFERENCES
 1   Muralikrishna & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011.
 2   Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.
 3   Rizvi, Ashraf. M, Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
 4   Mitra K. Barun, "Effective Technical Communication – A Guide for Scientists and Engineers", Oxford University Press, New Delhi, 2006.
 5   Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Apply knowledge about the various principles of communication and its various stages.
CO2   Imply the importance of verbal and non-verbal communication in the professional world along with its uses.
CO3   Review the grammar – verbs and its different forms and application of the different forms of advanced grammar.
CO4   Apply grammatical knowledge which enhances speaking and writing skills to prepare reports and resume in a professional manner.
CO5   Speak clearly, confidently, comprehensively, and communicate with one or many listeners using appropriate communicative strategies.

16MA102	ENGINEERING MATHEMATICS II	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	1	0	4

UNIT I   MULTIPLE INTEGRALS   9+3

Double integration in Cartesian co-ordinates – Change of order of integration – Triple Integrals – Simple problems – Area and volume by multiple integrals.

UNIT II   VECTOR CALCULUS   9+3

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple problems involving cubes and rectangular parallelepipeds.

UNIT III   COMPLEX DIFFERENTIATION   9+3

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions using Milne Thomson's method – Conformal mapping : w= z + c, cz, 1/z, and bilinear transformation.

UNIT IV   COMPLEX INTEGRATION   9+3

Complex integration – Statement and Problems of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's expansion – Singular points – Residues – Residue theorem – Problems only.

UNIT V   LAPLACE TRANSFORMS   9+3

Laplace transform – Conditions for existence (statement only) – Transforms of standard functions – Properties (statement only) – Transforms of derivatives and integrals – Initial and Final value theorems (statement only) – Periodic functions - Inverse transforms – Convolution theorems (statement only) – Applications of Laplace transforms for solving the ordinary differential equations up to second order with constant co-efficient.

L :45   T:15   P:0   Total: 60 PERIODS

TEXT BOOKS
1 Bali, N. P. and Manish Goyal, "Text book of Engineering Mathematics", 4th Edition, University Science Press, 2014.
2. Grewal, B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.

REFERENCES
1 Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2014.
2 Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Engineering Mathematics", Volume I., S. Chand & Co., New Delhi, 2012.
3 Jain, R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House Pvt. Ltd., 2015.
4 Kreyszig, E., "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons, Inc, Singapore, 2008.
5 Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education Ltd., 2013.

COURSE OUTCOMES
At the end of the course student should be able to:

CO1   Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
CO2   Know the gradient, divergence and curl, related theorems useful for engineering applications.
CO3   Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
CO4   Evaluate real and complex integrals over suitable closed paths or contours.
CO5   Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

16PY102 **PHYSICS OF MATERIALS** L T P C

(Common to All B.E. / B. Tech. Courses) 3 0 0 3

UNIT I **CONDUCTING AND SUPERCONDUCTING MATERIALS** **9**

Classification of materials based on conductivity- Conductors –Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals. Superconductors – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) –High T_c superconductors – Application of superconductors –SQUID, Magnetic levitation.

UNIT II **SEMICONDUCTING MATERIALS** **9**

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

UNIT III **MAGNETIC MATERIALS** **9**

Basic concepts – magnetic moment, susceptibility, permeability. Origin of magnetic moment – Bohr magneton –Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications. Magnetic storage devices- magnetic hard disc, bubble memory.

UNIT IV **DIELECTRIC MATERIALS** **9**

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

UNIT V **ADVANCED ENGINEERING MATERIALS** **9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, applications – Nanomaterials: Properties –Top-down process: Ball milling method- Bottom –up process: Chemical vapour deposition method- Carbon Nanotubes- Preparation by pulsed laser deposition method, properties and applications.

L :45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS
1 Charles Kittel, Introduction to Solid State Physics, Wiley Publications, 2006.
2 Ragavan V, "Materials Science and Engineering:, PHI Learning Private, 2012.

REFERENCES
1 Rajendran.V, Engineering Physics, Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.
2 Neil W.Ashcroft, N.David Mermin, Solid state physics, Cengage Publication, 2011.
3 S.O.Pillai, Solid State Physics, New Age International, New Delhi, 2005.
4 William D.Callister, Material Science and Engineering, Wiley Publications, 2006.
5 Dr.G.Senthil kumar, Engineering Physics-II, VRB Publishers Pvt.Ltd. Chennai.(2013).

COURSE OUTCOMES :

At the end of the course student should be able to:

CO1 Understand the properties and applications of conducting, super conducting materials

CO2 Identify the electrical properties of semiconducting materials.

CO3 Classify the magnetic materials based on the properties and employ it to act as an memory storage device.

CO4 Understand the various types of polarisation and applications of dielectric materials.

CO5 Comprehend the preparation and properties of advanced engineering materials for industrial applications.

16CH102   **ENVIRONMENTAL SCIENCE AND ENGINEERING**   **L**   **T**   **P**   **C**
                      (Common to All B.E. / B. Tech. Courses)   **3**   **0**   **0**   **3**

UNIT I   ENVIRONMENT & BIODIVERSITY   9

Definition, scope and introduction –planet earth (atmosphere, lithosphere & hydrosphere) of environment. Introduction to biodiversity definition: genetic, species and ecosystem diversity –Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values–threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II   AIR &NOISE POLLUTION   9

Air pollution - Atmospheric chemistry - Chemical composition of the atmosphere-Definition- causes, effects and control measures. Control of particulate and gaseous emission - Electrostatic precipitator – automobile emission - catalytic convertor - Acid rain- Green house effect - Global warming- -Air (Prevention & control of pollution act) - Noise pollution – Definition, effects & control of noise pollution.

UNIT III   WATER & SOIL POLLUTION   9

Water and their environment significance-Water quality parameters-Physical, chemical and biological parameters-Dissolved Oxygen-Biological Oxygen demand – Chemical Oxygen Demand (Definition only) - Water pollution- causes, effect & control measures-Sewage water treatment – Water (prevention & control of pollution act) - Soil pollution-Definition, causes, effects of soil pollution

UNIT IV   CONVENTIONAL & NON CONVENTIONAL ENERGY   9
                      RESOURCES

Conventional –   Coal – Gross net calorific value (Definition only) – Coke – Manufacture of coke – Otto Hoffmann method – Petroleum- Fractional distillation - Natural gas - LPG and CNG-Need for alternative energy resources –Nuclear energy- Fission and fusion reactions- Light water nuclear reactor for power generation (block diagram only) – Solar energy – Wind energy-H_2O_2 fuel cell. Role of an individual in conservation of energy resources

UNIT V   GREEN CHEMISTRY & ENVIRONMENTAL MANAGEMENT   9

Green chemistry- Principles of green chemistry – Water conservation – Rain water harvesting - Solid waste management: causes, effects and control measures of municipal solid wastes. Disaster management – Floods, Earthquake – Population growth – Population explosion and its consequences - Role of information technology in environment and human health.

                                     L :45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Dr.A.Ravikrishnan, "Environmental Science & Engineering"Sri Krishna Hitech Pub.Co.Pvt.Ltd.2013
2   Benny Joseph, "Environmental Science & Engineering" Tate McGraw-Hill Pub.Co.Ltd, New Delhi.2009.

REFERENCES

1   G.Tyler Miller, "Environmental Science" Cengage Learning India Pvt. Ltd. New Delhi.2011
2   Dr. Debang Solanki, "Principles of Environmental Chemistry" Prateeksha Pub.Jaipur.2011.
3   Gilbert M. Masters and Wendell. P.Ela, "Introduction to Environmental Engineering   and Science" PHI Learning Pvt. Ltd. New Delhi.2010
4   Deeksha Dave and S.S. Katewa, "Environmental Science & Engineering" Learning India Pvt. Ltd. New Delhi.2011
5   Benny Joseph "Environmental Science & Engineering" Tata McGraw-Hill Pub.Co.Ltd, New Delhi. 2009.

COURSE OUTCOMES :

At the end of the course student should be able to:
CO1   Understand the importance of fossil fuels as energy sources, development of alternative   sources of energy like solar, wind etc
CO2   Aware on green house effect, various types of pollutions and global warming
CO3   Know about the effects of automobile emission and its control measures
CO4   Gain knowledge about the protection of environment
CO5   Conscious on water conservation, rapid growth of population and advantages of   green chemistry

16EE102   **ELECTRIC CIRCUIT ANALYSIS**   **L   T   P   C**
                    (Common to EEE,EIE,BME)   **4   0   0   4**

UNIT I   BASIC CIRCUITS ANALYSIS   12

Ohm's Law – Kirchoffs laws – DC and AC Circuits: Peak value, Average value, Effective value (RMS) – Independent and Dependent voltage and current sources -Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits

UNIT II   NETWORK REDUCTION AND NETWORK THEOREMS FOR DC   12
                   CIRCUITS

Network reduction: voltage and current division, source transformation – star delta conversion, Thevenin's and Norton's Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity theorem

UNIT III   RESONANCE AND COUPLED CIRCUITS   12

Series resonance – frequency response – Quality factor and Bandwidth – Parallel Resonance (RL & RC circuit only) - Self and mutual inductance – Coefficient of coupling - Single tuned circuits.

UNIT IV   TRANSIENT RESPONSE FOR DC and AC CIRCUITS   12

Transient response of RL, RC and RLC series circuits using Laplace transform for DC input – Transient response of RLC series circuit for sinusoidal input.

UNIT V   ANALYSING THREE PHASE CIRCUITS   12

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents.

L : 60   T: 0   P: 0   Total: 60 PERIODS

TEXT BOOKS
1   William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002)
2.   Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, (2010)

REFERENCES
1   Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996)
2   Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw- Hill, New Delhi (2001)
3   Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second
    Edition, McGraw Hill, (2003)
4   Chakrabati A, "Circuits Theory Analysis and synthesis , Dhanpath Rai & Sons, New Delhi, (1999)
5   Arumugam & M.Prem Kumaran, "Electric Circuit Theory", Khanna Publishers, New Delhi, 2003

COURSE OUTCOMES
At the end of the course student should be able to:
 CO1   Apply the elementary concept of electric sources, elements and their properties in the circuits
 CO2   Design electrical circuits, analyse and interpret data using mathematical tools
 CO3   Calculate the electrical parameters in any practical circuits.
 CO4   Analyze three phase AC circuits
 CO5   Gain knowledge of DC resonance and transients circuits.

16ME104	ENGINEERING GRAPHICS	L	T	P	C
	(Common to CSE, ECE, EEE, EIE, IT and BIO)	3	0	2	4

UNIT I   PROJECTION OF POINTS, LINES AND PLANE SURFACES   9+6

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

UNIT II   PROJECTION OF SOLIDS   9+6

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

UNIT III   SECTION OF SOLIDS   9+6

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.

UNIT IV   ISOMETRIC PROJECTIONS & FREE HAND SKETCHING   9+6

Principles of isometric projection – isometric scale – isometric drawings of simple solids, truncated prisms, pyramids, cylinders and cones.

Free hand sketching:

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

UNIT V   BUILDING DRAWING   9+6

Drawing of a plan, Elevation and sectioning of security room and residential building (Two bed rooms, kitchen, hall, etc.)

L : 45   T: 0   P: 30   Total: 75 PERIODS

TEXT BOOKS

1 N.D. Bhatt and V.M. Panchal, "Engineering Drawing" Charotar Publishing House, 53rd Edition, (2016).
2 K. R. Gopalakrishnan, "Engineering Drawing" (Vol.I & II), Subhas Publications (2014).

REFERENCES

1 K. V. Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2016).

2 M.S. Kumar, "Engineering Graphics", D.D. Publications, (2016).

3 M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2015).

4 CADD Centre, Solid Edge, Reference Guide 14, 2015.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Draw projections of points, straight lines and plane surfaces.

CO2 Illustrate top view and front view of the solids.

CO3 Outline Sectioned Views of the solids.

CO4 Exhibit knowledge about isometric, perspective and orthographic projections.

CO5 Design simple residential and office buildings**.**

16GE112   **CAREER DEVELOPMENT PROGRAMME - II**   **L   T   P   C**

(Common to All B.E. / B. Tech. Courses)   **1   0   2   2***

UNIT I   LINGUISTIC SKILLS II   15

Goal Settings, Insights into pre-placement requisites, SWOT Analysis, LSRW Skills

UNIT II   QUANTITATIVE ABILITY III   8

Time, speed and distance -Train problems-Boats and streams, Time and work – Pipes and cisterns, Calendars, Venn diagram.

UNIT III   QUANTITATIVE ABILITY IV   7

Probability, Permutation &Combination, Mixtures & Allegation, Mensuration, Data Interpretation.

UNIT IV   PERSONALITY DEVELOPMENT   8

Personality, Presentation Skills – stages, selection of topic, content & aids, Minutes of meeting, Public speaking.

UNIT V   COMMUNICATION SKILLS   7

Power point presentation, Speak for three minutes, Online typing, Passage reading.

L :15   T: 0   P: 30   Total: 45 PERIODS

TEXT BOOKS
1   John Eastwood, "Oxford Practice Grammar", Oxford, 2006.
2   Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications, 2010.
3   Barun K. Mithra, 2016, "Personality Development & Soft Skills", Oxford.

REFERENCES
1   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication, 2012.
2   R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited, 2016.
3   Barun K. Mithra, 2014, "Personality Development & Soft Skills", Oxford.
4   Arun Sharma - Quantitative Aptitude for CAT.
5   Dr. Rishipal and Dr. Jyoti Sheoran "Business Communication", SPD Publisher, 2014.

COURSE OUTCOMES

At the end of the course students should be able to

CO1   Understand the field Linguistic techniques.
CO2   Communicate at the basic level in public speaking and write reports.
CO3   Solve time related problems.
CO4   Get the critical concepts through the mixture & allegation & data interpretation sums.
CO5   Write minutes of meeting and versatile presentations.

16ME111   **CAREER DEVELOPMENT PROGRAMME II (Python)**   **L   T   P   C**

                                                                     1   0   2   2*

UNIT I   INTRODUCTION TO PYTHON, CONTROL STRUCTURES   5+10

Introduction to python- Python Basis- Python Data Variables & Operators: id() and type() functions- Coding Standards.

Looping and Control Structures: Selection: if else- elif, Nested if. Iteration Control structures-Break, Continue & Pass. Repetition: while, for, Nested for.

UNIT II   COLLECTIONS, FUNCTIONS   5+10

Collections: Strings- Tuples- Lists- Sets &Dictionary, Sorting.

Functions: Defining & Calling a function- Passing arguments to functions - Mutable & Immutable Data Types- Different types of arguments- Scope of variables, Recursive Function, Example Program.

UNIT III   MODULES, PACKAGES, FILES AND EXCEPTION HANDLING   5+10

Modules and Package: Modules, Package, Example Programs.

File and Exception Handling: Text files, reading and writing files, format operator; try…except-- try…finally.

L :15   T: 0   P: 30   Total: 45 PERIODS

TEXT BOOKS
1   Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2   Harsh Bhasin "Python for Beginners", New Age International Publishers, 2016.

REFERENCES
1   R. Nageswara Rao "Core Python Programming", Second edition, Dream Tech Publishers, 2018.
2   Roberto Tamassia, Michael H. Goldwasser "Data Structures and Algorithms in Python", Wiley Publishers, 2016.
3   Guttag John V. "Introduction to Computation and Programming Using Python with Application to Understanding Data", Second edition, MT Tech Publishers, 2018.

COURSE OUTCOMES
At the end of the course students should be able to
CO1   learn and understand Python programming basics and paradigm
CO2   learn and understand python looping, control statements and string manipulations.
CO3   learn and know the concepts of file handling, exception handling and database connectivity

16CH103	**CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	(Common to All B.E. / B. Tech. Courses)	**0**	**0**	**2**	**1**

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA.
2. Determination of DO in water (Winkler's method)
3. Estimation of Chloride in Water sample (Argentometric).
4. Conductometric titration (Simple acid base).
5. Conductometric titration (Mixture of weak and strong acids vs strong base).
6. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$).
7. pH titration (acid & base).
8. Determination of inhibitor efficiency on the corrosion rate of steel in acid media by weight loss method.
9. Anodizing of aluminum and determination of thickness of anodic film.
10. Determination of cathode efficiency of nickel plating.

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Electronic balance
- pH meter
- Potentiometer
- Conductivity bridge
- Spectro Photometer
- Colorimeter
- IC regulated power supply
- Hot air oven

L : 0   T: 0   P: 30   Total: 30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:

CO1 Gain the experimental knowledge of testing the water.

CO2 Carry out titration using conductivity meter, potentiometer and pH meter.

CO3 Estimate the metal ions in industrial effluents.

CO4 Set up mini electroplating unit.

CO5 Determine the inhibitor efficiency on the corrosion rate of steel.

16EN103	COMMUNICATION SKILLS LABORATORY	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	0	0	4	2

UNIT I   LISTENING   15

Introduction to Business communication-Listening to Monologues-Listening for general content-Listening to dialogues-Listening to telephonic Conversation-Listening to conversation among three or more people-Listening to business conversations.

UNIT II   SPEAKING   15

Greetings, Formal and in formal introduction of self and others – Establishing business relationships and negotiating- Tongue twisters/pronunciation drills – Describing an object or event-Describing a working mechanism- Phrases for positive feedback, agreeing/disagreeing Group Discussion-Conversation techniques – Presentation skills-Interview techniques.

UNIT III   READING   10

Reading Techniques-Reading to understand –Facts, Inference, Main idea, Authors opinion and tone – Newspaper reading, Reading brochures- Reading and reviewing books, articles -Cloze exercises-Reading Comprehension-Reading a Technical Report-Critical Reading(Editorial):Creative and Critical Thinking.

UNIT IV   WRITING   15

Business Itinerary – Business Letters – Calling for Quotation-Placing Orders-Letter Seeking clarification- Letter requesting Information, explaining a situation- Resume & cover letter, Short prepared compositions on current affairs – Leaflets, Instruction Manual- Picture Perception-Encoding and decoding advertisements-Perceiving Visual Information-E-mail Etiquette and Correspondence-Expression indicating frequency/responding to situations and Providing solutions.

UNIT V   SOFT SKILLS   5

Emotional Intelligence- Inter & Intrapersonal skills-Teamwork/ Leadership skills -Decision making and Problem solving skills -Time & Stress management- Professional Ethics.

L : 0   T: 0   P:60   Total: 60 PERIODS

TEXT BOOKS
 1   Norman Whitby, Business Benchmark, Cambridge English, Second Edition, South Asian Edition 2014
 2   Guy Brook-Hart, Business Benchmark, Cambridge English, Second Edition, South Asian Edition 2014

REFERENCES
 1   Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, "Empower   English", Cambridge University Press, NY, USA. Updated Edition, 2016.
 2   Rizvi, Ashraf. M. "Effective Technical Communication". Tata McGraw-Hill, New Delhi. Updated Edition, 2015.
 3   Department of English, Anna University, "Mindscapes: English for Technologists and Engineers",Chennai, Updated Edition, 2015.
 4   Leo Jones, Richard Alexander, "New International Business English", Cambridge University Press, NY, USA. Updated Edition, 2009.
 5   Jeff Butterfield, "Soft skills for everyone", Cengage Learning, New Delhi, 2011.

COURSE OUTCOMES
At the end of the course student should be able to:

CO1   Face the challenges of the globalized world with confidence and with the best communicative skills.
CO2   Make learners imbibe listening and speaking skills in both formal and informal contexts.
CO3   Help them develop their reading skills by familiarizing them with different types of reading strategies.
CO4   Make them acquire language skills at their own pace by using e-materials and language lab components.
CO5   Enrich their creative and critical thinking and get through interviews successfully.

16EE103

ELECTRIC CIRCUITS LABORATORY
(Common to EEE, BME & EIE)

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws
2. Verification of mesh and nodal analysis
3. Verification of Thevenin's and Norton's Theorem
4. Verification of superposition Theorem
5. Verification of maximum power transfer Theorem
6. Verification of reciprocity theorem
7. Measurement of self inductance of a coil
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits
10. Measurement of various signals using CRO

MAJOR EQUIPMENTS / SOFTWARE REQUIRED
Hardware
- C.R.O
- D.C Power Supply(regulated)
- Function Generator

L : 0   T: 0   P:30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:

CO1	Understand the operation of electric circuits
CO2	Understand the concepts of various theorems on DC Circuits
CO3	Gain knowledge about resonance
CO4	Gain knowledge on inductance of a coil
CO5	Acquire the concepts of transients in electrical systems

16MA201   **TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**   **L T P C**

(Common to all B.E. / B. Tech. Courses)   **3   1   0   4**

UNIT I   FOURIER SERIES   **9+3**

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

UNIT II   FOURIER TRANSFORMS   **9+3**

Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity.

UNIT III   PARTIAL DIFFERENTIAL EQUATIONS   **9+3**

Formation of partial differential equations – Lagrange's linear equation –Solution of standard types of first order partial differential equations – Linear partial differential equations of second order with constant coefficients (Homogeneous Problems).

UNIT IV   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   **9+3**

Solutions of one dimensional wave equation – One dimensional equation of heat Conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT V   Z -TRANSFORMS AND DIFFERENCE EQUATIONS   **9+3**

Z- Transforms – Elementary properties – Inverse Z - Transform – Convolution theorem – Formation of difference equation – Solution of difference equations using Z - Transform.

L:45   T:15   P: 0   Total: 60 PERIODS

TEXT BOOKS
1 Grewal, B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.
2. Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES
1 Bali, N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Fifth Edition, Laxmi Publications (P) Ltd., 2014.
2 Glyn James, "Advanced Modern Engineering Mathematics", Fourth Edition, Pearson Education, 2013.
3 Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, Wiley India, 2015.
4 Ronald Bracewell, "The Fourier transforms & its Applications" 3rd Edition, 2012.
5 Zachmanoglou, E.C., "Introduction to partial differential Equations with Application", 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Know how to find the Fourier Series and half range Fourier Series of a function given explicitly or to find Fourier Series of numerical data using harmonic analysis.

CO2   Find the Fourier transform, sine and cosine transform of certain functions and use Parseval's identity to evaluate integrals.

CO3   Form partial differential equations and solve certain types of partial differential equations.

CO4   Solve one dimensional wave equation, one dimensional heat equation and two dimensional heat equation in steady state using Fourier Series.

CO5   Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

16BM201   **BIOCHEMISTRY AND TECHNOLOGY**   **L   T   P   C**

                                                            3   0   0   3

UNIT I   INTRODUCTION TO BIOCHEMISTRY   9
Introduction to Biochemistry, water as a biological solvent, acid and bases, pH, buffers, Handerson - Hasselbalch equation. Principle of osmosis and their application.
The Cell – Prokaryotic and eukaryotic cells.

UNIT II   CARBOHYDRATES   9
Classification of carbohydrates - mono, di, oligo and polysaccharides. D and L isomers, optical activity of sugars, epimers and enantiomers. Metabolic pathways and bioenergetics – Glycolysis, TCA cycle and electron transport chain.
Reactions of carbohydrates – Barfoed's test, Benedict's test.

UNIT III   LIPIDS   9
Classification of lipids- simple, compound and derived lipids. Fatty acids (Occurrence, Even and odd carbon fatty acids, saturated and unsaturated, nomenclature of fatty acids), Essential fatty acids. Cholesterol (Structure and occurrence).
Reactions of lipids - saponification test, solubility test, brown paper test

UNIT IV   NUCLEIC ACID & PROTEIN   9
Nucleotides – Purines and Pyrimidines, Nucleoside. DNA - Chargoffs rule. Watson and crick model of DNA. Structure of RNA and its type. Protein biosynthesis.
Chromatography - TLC, GLC, HPLC.

UNIT V   MINERAL METABOLISM AND SPECTROSCOPY   9
Biochemical Functions, Dietry requirements, Sources - Phosphorous, Magnesium, Sodium and Iron. Introduction to Spectroscopy- UV – Visible and IR spectroscopy – principles, instrumentation (Block diagram only).
Estimation of SGOT and SGPT.

                              L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
   1   Biochemistry, U Satyanarayana, Elsevier Health Sciences; Fourth Edition (2014)
   2   Lehninger Principles of biochemistry, David l. nelson, W H Freeman & Co; Sixth edition (2013)

REFERENCES
   1   Biochemistry, Donald Voet, Judith G. Voet, Wiley, John & Sons; third edition,(2003)
   2   Biochemistry, LubertStryer, John L. Tymoczko, Jeremy Mark Berg, W. H. Freeman Company; Fifth edition, (2002)
   3   Biochemistry, Christopher K. Mathews, Kensal E. van Holde, Kevin G. Ahern, Pearson Benjamin Cummings; Third edition, Book and CD-ROM edition, (1999).

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Understand the concept of Biochemistry
CO2   Relate the Classification, structure and properties of Carbohydrates
CO3   Design the structure, classification and properties of Lipids
CO4   Recognize the Classification, structure and properties of Protein and Nucleic acid
CO5   Analyze the advanced knowledge about Mineral Metabolism and Spectroscopy

16BM202	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
		3	0	0	3

UNIT I   BASIC ELEMENTS OF HUMAN BODY   8
Cell: Structure and organelles - Functions of each component in the cell. Cell membrane –transport across membrane – origin of cell membrane potential – Action potential. Tissue: Types – Specialized tissues – Epithelial – Connective – Muscular – Nervous - functions.

UNIT II   SKELETAL SYSTEM& RESPIRATORY SYSTEM   9
Skeletal system: Bones - types: Long – Short – Flat – Irregular – functions. Joint - Types: Fibrous – Cartilaginous – Synovial. Cartilage – Hyaline – Elastic – Fibro - functions.
Respiratory System: Components of respiratory system: Nose – Pharynx – Larynx – Trachea – Bronchi – Lungs. Respiratory Mechanism: Inspiration – Expiration. Types of respiration: External – Internal - Oxygen and carbon dioxide transport and acid base regulation.

UNIT III   CIRCULATORY SYSTEM   10
Blood composition - functions of blood – functions of RBC, WBC& Blood Platelet - types and functions. Blood groups – Identification of blood groups. Blood vessels
Heart: Anatomy & Physiology – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – ECG - Heart sound - Volume and pressure changes and regulation of heart rate –Coronary Circulation. Factors regulating Blood flow.

UNIT IV   URINARY AND SPECIAL SENSORY SYSTEM   9
Urinary system: Kidney and Nephron - Anatomy & Physiology; Mechanism of Urine formation and acid base regulation – Urinary reflex – Homeostasis and blood pressure regulation by urinary system. Special senses: Eye – Anatomy & Physiology, Ear - Anatomy & Physiology.

UNIT V   NERVOUS SYSTEM   9
Neural System: Neuron: Anatomy & Physiology – Types of Neuron. Synapses and types. Conduction of action potential in neuron. Brain – Divisions of brain lobes - Cortical localizations and functions - EEG. Spinal cord – Tracts of spinal cord - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Gerard J. Tortora & Nicholas P. Anagnostakos, "Principles of Anatomy and Physiology", Harper & Row Publishers, New York
2. Elaine.N. Marieb , "Essential of Human Anatomy and Physiology", Eight Edition, Pearson Education, New Delhi ,2007
3. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2009 Company, Harcourt Brace Jovanovich, 2003

REFERENCES
1. William F.Ganong, "Review of Medical Physiology", 22nd Edition, McGraw Hill, New Delhi, 2005
2. Eldra Pearl Solomon, "Introduction to Human Anatomy and Physiology", W.B. Saunders, 2015
3. Guyton & Hall, "Medical Physiology", 12th Edition, Elsevier Saunders, 2010

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Describe basic structural and functional elements of human body
CO2 Explain organs and structures involving in system formation and functions
CO3 Identify circulatory system and measurements associated with it
CO4 Understand urinary and special sensory system
CO5 Analyze the nervous system and its functions

16BM203	**BIOMEDICAL SENSORS AND INSTRUMENTS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

UNIT I   SENSORS &MEASUREMENT   9

Measurement System– Instrumentation–Classification and Characteristics of Transducers–Static and Dynamic–Errorsin Measurements. Strain Gauge: Bounded & Unbounded strain gauge, strain gauge as displacement-pressure transducers -Capacitive transducer - Inductive transducer –LVDT – RTD – Thermistor – Thermocouple – Phototube -scintillation counter -Photo Multiplier Tube (PMT) –Piezoelectric transducer as pressure transducer- Ultrasound transducer – biomedical applications of all the transducers.

UNIT II   SIGNAL RECORDERS   9

Digital voltmeter– Multi meter– CRO– block diagram, CRT– DSO - LCD monitor –PMMC writing systems -servo recorders –photographic recorder –magnetic tape recorder -Inkjet recorder –thermal recorder.

UNIT III   BIOPOTENTIAL ELECTRODES & CONFIGURATION   9

Origin of biopotential and its propagation – Electrode – electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes: surface, needle and microelectrodes -Biosignals (ECG, EEG, EMG) characteristics: frequency and amplitude ranges - ECG: Einthoven's triangle, standard12 lead system –EEG: 10-20 electrode system, unipolar, bipolar and average mode –EMG: unipolar and bipolar mode.

UNIT IV   MEASUREMENTOF NON-ELECTRICAL PARAMETERS   9

Temperature, respiration rate and pulse rate measurements –Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers -systolic, diastolic, mean detector circuit –Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method -Electromagnetic and ultrasound blood flow measurement.

UNIT V   BIO-CHEMICAL MEASUREMENT   9

Biochemical sensors-pH, pO2 and pCO2 -Blood glucose sensors-Blood gas analyzers –colorimeter – flame photometer –spectrophotometer -blood cell counter –auto analyzer (simplified schematic description).

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1. A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation", 10th edition, Dhanpat Rai & Co, New Delhi, 2010.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.

REFERENCES

1. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.
2. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 5th edition, McGraw-Hill, 2007.
3. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.
4. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004.
5. L.A Geddas and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and Sons, Third Edition, Reprint 2008.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Describe the purpose and methods of measurements
CO2 Explain different display and recording devices for various applications
CO3 Understand the various electrodes and its configuration to take biomedical signals
CO4 Perform electrical and non-electrical physiological measurements
CO5 Perform biochemical measurements

16IT206   **DATA STRUCTURES AND ALGORITHMS**   **L   T   P   C**

                         (Common to EEE, ECE & EIE)   **3   0   0   3**

UNIT I   LINEAR STRUCTURES   9
Abstract Data Types (ADT)-List ADT-Array, Linked List and Cursor Implementations of List ADT-Linked Lists and its Types- Stack ADT-Queue ADT -Application of List, Stack and Queue.

UNIT II   TREE STRUCTURES   9
Tree ADT-Tree Traversals: In-order traversal- Pre-order traversal - Post order traversal -Binary Tree ADT- -Applications of Trees - Binary Search Tree ADT- AVL Trees-AVL Tree Rotations – Huffman Tree-Binary Heaps

UNIT III   GRAPHS   9
Definitions - Topological Sort-Breadth First Traversal- Depth First Traversal – Dijkstra's Shortest Path Algorithm - Minimum Spanning Tree - Prim's and Kruskal's Algorithms - Floyd's Algorithm-Applications of Graphs

UNIT IV   INDEXING AND SORTING   9
Hashing: Separate Chaining - Open Addressing - Linear Probing – Sorting: Bubble Sort -Insertion Sort - Heap Sort - Merge Sort - Shell Sort - Quick Sort

UNIT V   ALGORITHM DESIGN AND ANALYSIS   9
Algorithm Analysis- Asymptotic Notations- Greedy Algorithms (Prim's algorithm) - Divide and Conquer(Merge sort) - Dynamic Programming (Floyd's Algorithm) - Backtracking (8 Queens problem) – Branch and Bound (Travelling Salesman Problem) – NP Complete Problems (Graph coloring problem)

                    L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 2nd Edition, 2007
2   M.A.Weiss ,"Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, 2005.

REFERENCES
1   Tremblay Jean Paul and Sorenson Paul G, "An introduction to data structures with applications", Tata McGraw-Hill, 2nd Edition, 2007
2   R.F.Gilberg and B.A.Forouzan, "Data Structures: A Pseudocode Approach with C",Thomson India Edition, 2nd Edition, 2005
3   Sara Baase and A.Van Gelder, "Computer Algorithms", Pearson Education, 3rd Edition,2003
4   T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms",Prentice Hall of India Ltd, 2nd Edition, 2001
5   A. M. Tenenbaum, Y. Langsam and M. J. Augenstein, "Data Structures using C", Pearson Education, 2nd Edition, 1998

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Design linear and non linear data structures in align with real time problems
CO2   Analyze the real time problems
CO3   Differentiate tractable and intractable problems
CO4   Understand memory allocation and retrieval methodologies
CO5   Apply various algorithm design techniques for problem solving.

16EE202	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
	(Common to EEE,EIE,BME, CSE & IT)	3	0	0	3

UNIT I   PN JUNCTION DEVICES   9

Overview of Semiconductors – PN junction diode : Structure, Operation and V-I Characteristics, Diffusion and Transition capacitance, Zener diode – Characteristics – Diode Applications : Rectifiers, Clipper and Clamper. LED, Laser diode, Photodiode - PV Cells

UNITII   TRANSISTORS   9

BJT- JFET - MOSFET – Structure, Operation, Characteristics and Biasing. UJT, SCR, TRIAC: Structure and Characteristics. Photo transistor - Opto-isolators.

UNIT III   SMALL SIGNAL AMPLIFIERS   9

BJT small signal model – Analysis of CE, CB, CC amplifiers – Gain and frequency response. Multistage Amplifiers – Cascade connection, Darlington connection – Differential amplifier : Dual input balanced output – Common mode and differential mode analysis. (Qualitative Treatment only)

UNIT IV   POWER AMPLIFIERS AND SWITCHING CIRCUITS   9

Transformer coupled Class A, Class B push pull, Class AB push pull & Class C amplifiers – crossover distortion. Multivibrator – Monostable, astable and bistable multivibrator – Schmitt triggers.

UNIT V   FEEDBACK AMPLIFIERS AND OSCILLATORS   9

Advantages of negative feedback – voltage / current-series /shunt feedback –positive Feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1 David A. Bell , "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008.
2. Jacob Millman, Christo C Halkies and Sathyabarath Jit "Electronic Devices and Circuits", Tata McGraw Hill, 2008.

REFERENCES
1 Floyd, "Electronic Devices" Pearson Asia 7th Edition, 2009.
2 Vinoth Kumar Khanna, "Insulated Gate Bipolar Transistor IGBT Theory and Design", Wiley-IEEE Press, 2004.
3 Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2006
4 S.Poornachandra, B.Sasikala, "Electronic Devices and Circuits", Scitech Publications India, (P) Ltd, Chennai, 2010.
5 Salivahanan.S, Vallavaraj.A and Kumar.N.S, "Electronic Devices and Circuits" Tata McGraw Hill, 2012.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Explain the structure of the basic electronic devices
CO2 Analyze the switching characteristics of transistors
CO3 Model the different configuration of Small signal amplifier
CO4 Construct the power amplifiers and switching circuits
CO5 Design the applications of electronic gadgets using the basic electronic devices

16GE211   **CAREER DEVELOPMENT PROGRAMME - III**   L   T   P   C

                 (Common to All B.E. / B. Tech. Courses)   1   0   2   2*

UNIT I   PERSONALITY DEVELOPMENT & SOFT SKILLS   **8**

Body Language – Introduction, Grooming, Postures and Gestures, Dressing Etiquettes, Hygiene & Cleanliness, Time Management. Resume Building – Introduction, difference between Resume and CV, Strategy of resume writing Body of the resume, Clarity and Crispness, Format and Content, Code of Conduct.

UNIT II   LINGUISTIC SKILLS III   **15**

Synonyms & Antonyms, Error Spotting, Paragraph Writing, Word Substitution, Jumbled words, Spellings, Dialogue Writing, Presentation.

UNIT III   VERBAL REASONING   I   **8**

Analytical reasoning - Linear, Circular & Complex arrangement, Blood relation, Direction Problems.

UNIT IV   VERBAL REASONING   II   **7**

Logical reasoning – Number and Alpha series, Odd man out, Element series, Logical series, Coding and

decoding, Syllogisms, Alphabets.

UNIT V   PRACTICALS   **7**

Extempore speech, Online typing, Mock Interview, Case based interview, Passage writing.

                          L :15   T: 0   P: 30   Total: 45 PERIODS

TEXT BOOKS
   1   Barun K. Mithra, "Personality Development & Soft Skills", Oxford, 2006.
   2   S.P.Bakshi, "Objective English" Arihant Publications, 2014.

REFERENCES
   1   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication, 2013.
   2   John Eastwood, "Oxford Practice Grammar", Oxford, 2006.
   3   Barun K. Mithra, 2015, "Personality Development & Soft Skills", Oxford.
   4   Arun Sharma - Quantitative Aptitude for CAT.
   5   Dr. Rishipal and Dr. Jyoti Sheoran "Business Communication", SPD Publisher, 2014.

COURSE OUTCOMES

At the end of the course students should be able to
CO1   Improves their personality through non-verbal communication and write good resume.
CO2   Write sentences and dialogues through paragraph & dialogue writing.
CO3   Apply their analytical thinking.
CO4   Think logically in critical situations.
CO5   Face the interviews confidently through attending the mock interview sessions.

16GE213　　　**CAREER DEVELOPMENT PROGRAMME - III**　　**L　T　P　C**
　　　　　　　(Common to All B.E. / B. Tech. Courses)　　　　**1　0　2　2***

UNIT I　　　　**LINGUISTIC SKILLS I**　　　　　　　　　　　　　**8**

Parts of speech, Transformation of sentences-simple, complex, compound, Homonyms, Question tags.

UNIT II　　　　**LINGUISTIC SKILLS II**　　　　　　　　　　　　**15**

Synonyms, Antonyms, Cloze Test, Voice, Idioms & Phrases. Verbal Analogies.

UNIT III　　　　**VERBAL ABILITY I**　　　　　　　　　　　　　**8**

Logical sequence of words, Jumbled Words, Spellings, One word substitution.

UNIT IV　　　　**VERBAL ABILITY II**　　　　　　　　　　　　　**7**

Comparison, Paragraph formation, Error spotting

UNIT V　　　　**VERBAL ABILITY III**　　　　　　　　　　　　　**7**

Comprehension-comprehend and understand a passage, Dialogue Writing, Power point Presentation.

L :15　T: 0　P: 30　Total: 45 PERIODS

TEXT BOOKS
1　Dr. Aggarwal R.S and Monika Agarwal, "Objective General English", New Delhi, Sultan Chand and Company Ltd., 1999.
2　Arun Sharma & Meenakshi Upadhay," Verbal ability and Reading comprehension". Mc Graw Hill Education.

REFERENCES
1　Aptimithra , McGraw Hill Publications, 2012.
2　Ajaysingh, Verbal ability and Reading comprehension", Arihant publication.
3　Hedge, T. (2000). Teaching and learning in the language classroom. Oxford, Oxford University Press.
4　Dutt Kiranmai.P, Rajeevan Geethe & Prakash C.L.N 'A course in Communication Skills ,First publications Cambridge University Press India Pvt.Ltd , 2008.
5　Brown, D. (1995). Teaching by Principles-An Interactive Approach to Language Pedagogy. Prentice Hall.

COURSE OUTCOMES

At the end of the course students should be able to

CO1　　Understand the importance & fundamentals of communication.
CO2　　Start speaking and writing in English without making any mistakes.
CO3　　Develop presentation skills.
CO4　　Think logically in critical situations.
CO5　　Prepare the questionnaire.

16BM241   **BIOCHEMISTRY AND HUMAN PHYSIOLOGY**   **L   T   P   C**
                                    LABORATORY

                                                                  0   0   2   1

LIST OF EXPERIMENTS

1. General tests for carbohydrates
2. General tests for proteins
3. General tests for lipids
4. Preparation of serum and plasma from blood
5. Estimation of blood glucose
6. Estimation of cholesterol
7. Estimation of creatinine
8. Estimation of urea
9. ESR , PCV
10. Hemoglobin estimation
11. Blood grouping and RH typing
12. Total count of RBCs (Demonstration)
13. Separation of amino acids by thin layer chromatography (Demonstration)

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Spectrophotometer
- Colorimeter
- Weighing balance
- Refrigerator
- Vortex Shaker
- TLC, ready TLC plates
- Wintrobe's tube
- Centrifuge Normal
- Micro slides
- Lancet
- Microscope
- Neubaur's Chamber
- Heparinized Syringe
- Haemoglobinometer
- Capillary tubes
- Blood grouping kit

                                        L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
- **CO1** Do estimation and interpret the changes in bio molecules.
- **CO2** Separate and analyze the importance of macromolecules.
- **CO3**   Estimate the creatinine, urea and cholesterol contents.
- **CO4** Estimate the level of Hemoglobin and perform RBC count
- **CO5** Understand the process of separation of amino acids and DNA.

16IT207   DATA STRUCTURES AND ALGORITHMS LABORATORY   L   T   P   C

(Common to ECE, EEE & EIE)   0   0   2   1

LIST OF EXPERIMENTS

1. Implement List ADT using Array
2. Construct Singly Linked List
3. Doubly Linked List Implementation
4. Implementation of Stack ADT (Using Linked List)
5. Implementation of Queue ADT (Using Array)
6. Implementation of Heap Sort
7. Implementation of Quick Sort
8. Implement Prim's Algorithm
9. Develop any stack Application
10. Implementation of Tree Traversal Algorithms

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

Hardware
- 30 PCs
- Processor-2.0 GHz or Higher
- RAM-256 MB or Higher
- Hard disk-20 GB or Higher

Software
- TURBO C version 3 (or) GCC version 3.3.4
- OS-Windows2000/Windows XP/NT

L : 0   T: 0   P: 30   Total: 30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:

CO1 Design algorithms and employ appropriate advanced data structures for solving
problems efficiently

CO2 Understand various data structure such as stacks, queues, trees, graphs, etc

CO3 Implement various hashing techniques to avoid collision

CO4 Implement various kinds of searching and sorting techniques, and know when to choose which
technique

CO5 Construct a suitable data structure and algorithm to solve a real world problem.

16BM242   ELECTRONIC DEVICES AND CIRCUITS LABORATORY   L   T   P   C

<div align="right">

0   0   4   2

</div>

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode and Zener Diode
2. Characteristics of NPN Transistor under CE, CC and CB configurations.
3. Characteristics of JFET
4. Characteristics of UJT
5. Frequency Response Characteristics of a CE amplifier
6. Characteristics of Photodiode and Phototransistor
7. Design of testing of RC phase shift, LC oscillators.
8. Single Phase half wave and full wave rectifiers.
9. Differential amplifiers using BJT.
10. Characteristics of SCR and TRIAC.
11. Study of Astable and Monostable multi vibrators.

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- RPS (0 – 30)V
- Dual Trace CRO (20 MHz)
- Function Generators
- Digital Multimeters
- Bread Boards
- BJTs, JFETs, UJTs – Transistors
- SCRs, TRIAC– Power Devices
- PN Diodes
- Zener Diodes
- Photo Diodes and Photo Transistors
- Milli Ammeters of various ranges
- Micro Ammeters of various ranges
- Voltmeters of various ranges
- Resistors of various ranges
- Capacitors of various ranges

<div align="right">

L : 0   T: 0   P: 60   Total:60 PERIODS

</div>

COURSE OUTCOMES
At the end of the course student should be able to:

CO1   Understand the characteristics of diodes and BJT
CO2   Understand the characteristics of JFET and UJT
CO3   Understand the working of photodiode and phototransistor
CO4   Understand the working of HWR and FWR
CO5   Analyze the working of Multivibrators

16MA202	STATISTICS AND NUMERICAL METHODS	L	T	P	C
	(Common to AERO, AUTO, CIVIL, C&P, EEE, E&I, IT, MECH, MCT, MAE, BME)	**3**	**1**	**0**	**4**

UNIT I   TESTING OF HYPOTHESIS   9+3

Sampling distributions – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit-Independence of attributes.

UNIT II   DESIGNS OF EXPERIMENTS   9+3

Completely Randomized Design – Randomized block design – Latin square Design – 2^2 factorial design.

UNIT III   SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS   9+3

Newton Raphson method – Gauss Elimination method – Pivoting Gauss Jordan methods – Iterative methods of Gauss - Jacobi and Gauss - Seidal – Matrix Inversion by Gauss - Jordan method – Eigen values of a matrix by power method.

UNIT IV   INTERPOLATION, NUMERICAL DIFFERENTIATION AND   9+3
                     NUMERICAL INTEGRATION

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's $1/3^{rd}$ rules.

UNIT V   NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL   9+3
                   EQUATIONS

Taylor's series method – Euler's method – Modified Euler's Method – Fourth order Runge-Kutta method for solving first and second order equations – Milne's Predictor – corrector methods for solving first order equations.

L:45   T:15   P: 0   Total: 60 PERIODS

TEXT BOOKS
1. Johnson, R.A., and Gupta,C.B., Miller and Freund's, "Probability and statistics for Engineers", Pearson Education Asia,8th Edition, 2011.
2. Grewal, B.S and Grewal, J.S, "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2012 .

REFERENCES
1. Spiegel,M.R., Schiller, J. and Srinivasan,R.A., "Schaum's Outlines Probabilty and Statistics", Tata McGraw Hill edition, 3rd Edition, 2011.
2. Chapra, S.C and Canale, R.P., "Numerical Methods for Engineers", 6th Edition, Tata McGraw Hill Edition, 2014 .
3. Gerald, C.F. and Wheatley, P.O. "Applied Numerical Analysis", 8th Edition, Pearson Education, Asia, New Delhi, 2014.
4. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
5. Kandasamy, P., Thilagavathy. K and Gunavathy, K., "Numerical Methods", 3rd Edition, S.Chand & Company Pvt. Ltd, 2013.

COURSE OUTCOMES
At the end of the course student should be able to:

CO1   Apply the statistical concepts and tools for engineering applications and to use different types of research methodology techniques for decision making under uncertainty.

CO2   Perform the ANOVA calculation which is needed for engineering research and project management.

CO3   Solve a set of algebraic equations representing steady state models formed in engineering problems

CO4   Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration.

CO5   Predict the system dynamic behaviour through solution of ODEs modeling the system.

16BM220   **PATHOLOGY AND MICROBIOLOGY**   L   T   P   C
                                                                     3   0   0   3

UNIT I   CELL DEGENERATION, REPAIR AND NEOPLASIA   9
Cell injury and Necrosis, Apoptosis, Inflammation and Repair including fracture healing. Classification, Benign and Malignant tumors, carcinogenesis, spread of tumors. Autopsy and biopsy.

UNIT II   FLUID AND HEMODYNAMIC DERRANGEMENTS   9
Edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, Hematological disorders - Bleeding disorders, Leukaemia.

UNIT III   MICROSCOPES   9
Light microscope – bright field, dark field, fluorescence, Electron microscope (TEM & SEM). Staining methods – simple, gram staining and AFB staining.

UNIT IV   MICROBIAL TECHNOLOGY   9
Morphological features and structural organization of bacteria, growth curve, identification of bacteria and fungi.
Bacterial culture media - classification and its types.

UNIT V   IMMUNOHEMATOLOGY   9
Introduction - Immunohematology, Principles of antigen and antibody and its types. Blood - serum and plasma. The ABO blood group systems, the cross match – compatibility test.
Immunological techniques: Immuno electrophoresis, RIA and ELISA.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
  1   Textbook of Microbiology, Ananthanarayan and Paniker's, Universities Press; Eighth edition (2009).
  2   Robbins Basic Pathology, Vinay Kumar, Elsevier Health Sciences; Eighth edition (2013).

REFERENCES
  1   Prescott's Microbiology, Joanne Willey, McGraw-Hill Education; Tenth edition (2016).
  2   Microbiology, Gerard J. Tortora, Berdell R. Funke and Christine L. Case; Pearson, twelfth edition (2014).
  3   Brock Biology of Microorganisms, Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl and Thomas Brock; Benjamin/Cummings Pub Co, fourteenth edition (2014).

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Recognize the creation and destruction of structural and functional aspects of living organisms
CO2   Know the etiology and remedy in treating the pathological diseases
CO3   Understand the different types of microscopes and its uses
CO4   Analyze of morphological features of different micro organism
CO5   Recite the importance of public health

16BM221	ANALOG AND DIGITAL ICs	L	T	P	C
		3	0	0	3

UNIT I   NUMBER SYSTEMS AND LOGIC GATES   9

Decimal, Binary, Octal and Hexadecimal Numbers - Conversion between these number systems - Complements 1's and 2's complements- subtraction using complements – Encoding numbers and characters using Binary digits – Binary coded Decimal – Gray code - Binary to Gray code conversion – ASCII Code. Logic gates – Truth tables – NOT, AND, OR, NOR, NAND, XOR, XNOR - Boolean Laws and theorems – Solving Boolean expressions, Truth Tables and Logic circuits – The Karnaugh Map – half adder - full adder - Multiplexers - Demultiplexers - Decoders - encoders.

UNIT II   REGISTERS AND COUNTERS   9

Flip Flops – RS, D, T, JK Flip Flops – Characteristic equations, exciting tables – JK Master-Slave flip-flop – Universal shift register - Design of modulo-N counters – counter design using state diagram.

UNIT III   OPERATIONAL AMPLIFIERS   9

The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth - equivalent circuit of an op-Amp – virtual ground concept – Linear applications of op-amp – inverting and non-inverting amplifier, summing, subtracting, averaging amplifier - voltage to current converter – current to voltage converter – Differential amplifiers – differentiator - integrator - Nonlinear applications: comparator, Schmitt Triggers, Precision diode Half wave, full wave rectifiers, Average detectors, peak detector

UNIT IV   ACTIVE FILTERS AND SIGNAL GENERATOR   9

Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters – Oscillators: RC Phase shift, Wein-bridge - Waveform generators: Square, triangular and saw tooth.

UNIT V   TIMER, PLL, A/D AND D/A CONVERTERS   9

555 Timer (internal diagram) and its applications – monostable multi-vibrator, astable multi-vibrator. Phase locked Loop (565 - block diagram approach) and its applications: Frequency multiplication, Frequency translation, voltage to frequency and frequency to voltage converters. DAC: Binary weighted DAC and R-2R DAC. ADC: single slope and dual slope ADCs, successive approximation ADC

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1. Morris Mano M., "Digital Logic and Computer design" Prentice Hall 1994.
2. Roy Choudary D., "Linear Integrated circuits", McGraw-Hills, 2003

REFERENCES

1. Ramakant A. Gayakwad , "Op-AMP and Linear Ics", Prince Hall, 1994
2. Thomas L. Floyd, "Digital Fundamental", Pearson Education, 10th Edition, 2016
3. Millman J and Halkias C., "Integrated Electronics", TMH, 2007.
4. John. F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007.
5. Charles H. Roth, Jr, "Fundamentals of Logic Design", Fourth Edition, Jaico Books, 2002

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Understand the basic of the Digital systems
CO2   Design of Registers and Counters using digital ICs
CO3   Understand the basic characteristics of analog ICs
CO4   Identify the applications of analog ICs
CO5   Study the various analog IC circuits for waveform generation and filtering

16BM222	MEDICAL PHYSICS	L	T	P	C
		3	0	0	3

UNIT I   **NON IONIZING RADIATION AND ITS MEDICAL**   **9**
                   APPLICATION

Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light, Measurement of light and its unit- limits of vision and color vision an overview, Thermography – Application

UNIT II   **SOUND IN MEDICINE**   **9**

Physics of sound, Normal sound levels –ultrasound fundamentals – Generation of ultrasound (Ultrasound Transducer) - Interaction of Ultrasound with matter; Cavitations, Reflection, Transmission-Scanning systems – Artefacts- Ultrasound- Doppler-Double Doppler shift-Clinical Applications.

UNIT III   **PRINCIPLES OF RADIOACTIVE NUCLIDES**   **9**

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Technetium generator**.**

UNIT IV   **INTERACTION OF RADIATION WITH MATTER**   **9**

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.

UNIT V   **BASIC RADIATION QUANTITIES**   **9**

Introduction -exposure- Inverse square law-KERMA-Kerma and absorbed dose –stopping power - relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg's curve- concept of LD 50- Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1.   John R Cameran, James G Skofronick "Medical Physics" John-Wiley & Sons. 1978
2.   W.J. Meredith and J.B. Massey "Fundamental Physics of Radiology" Varghese Publishing house. 1992

REFERENCES
1.   P. Uma Devi, A. Nagarathnam , B S SatishRao , "Introduction to Radiation Biology" B.I Chur Chill Livingstone pvt Ltd, 2000.
2.   S.Webb" The Physics of Medical Imaging", Taylor and Francis, 1988.
3.   J.P.Woodcock, Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Analyze the physics of light.
CO2   Understand the use of sound in medicine.
CO3   Understand principles of radioactive nuclides
CO4   Analyze the interaction of radiation with matter.
CO5   Understand the basic radiation quantities

16BM223	BIOMATERIALS AND ARTIFICIAL ORGANS	L	T	P	C
		3	0	0	3

UNIT I   STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY   9

Definition and classification of bio-materials, mechanical properties, visco elasticity, wound healing process, body response to implants, blood compatibility.

UNIT II   IMPLANT MATERIALS   9

Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite, glass ceramics, carbons, medical applications.

UNIT III   POLYMERIC IMPLANT MATERIALS   9

Polymerization, polyamides, Acryrilic polymers, rubbers, high strength Thermoplastics, medical applications. Bio polymers: Collagen and Elastin. Medical Textiles: Silica, Chitosan, PLA composites, Sutures, wound dressings. Materials for ophthalmology: contact lens, Intraocular lens. Membranes for plasma separation and Blood oxygenation.

UNIT IV   TISSUE REPLACEMENT IMPLANTS   9

Small intestinal submucosa and other decullarized matrix biomaterials for tissue repair. Soft tissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, Pancreas replacement.

UNIT V   ARTIFICIAL ORGANS   9

Artificial blood, Artificial skin, Artificial Heart, Prosthetic Cardiac Valves, Artificial lung (oxygenator), Artificial Kidney (Dialyser membrane), Dental Implants.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1   Sujata V. Bhatt, "Biomaterials", Second Edition, Narosa Publishing House, 2005
2   Park J.B., "Biomaterials Science and Engineering", Plenum Press, 1984

REFERENCES

1   Myer Kutz, "Standard Handbook of Biomedical Engineering & Design" Mc Graw Hill, 2003, Engineering", Elsevier, 2005.
2   John Enderle, Joseph D. Bronzino, Susan M.Blanchard, "Introduction to Biomedical
3   D F Williams, "Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume", VCH Publishers 1992.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Analyze different types of Biomaterials and its classification.
CO2   Analyze the use of metallic implant materials.
CO3   Analyze the polymeric implant materials.
CO4   Perform combinations of materials that could be used as a tissue replacement
CO5   Understand the various artificial organs used.

16BM224	BIOCONTROL SYSTEMS	L	T	P	C
		4	0	0	4

UNIT I   MODELING OF SYSTEMS   12

Terminology and basic structure of control system, example of a closed loop system, transfer functions, modeling of electrical systems, translational and rotational mechanical systems, and electro mechanical systems, block diagram and signal flow graph representation of systems, conversion of block diagram to signal flow graph, reduction of block diagram and signal flow graph.

UNITII   TIME RESPONSE ANALYSIS   12

Step and impulse responses of first order and second order systems, determination of time domain specifications of first and second order systems from its output responses, definition of steady state error constants and its computations.

UNIT III   STABILITY ANALYSIS   12

Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability, definition of dominant poles and relative stability.

UNIT IV   FREQUENCY RESPONSE ANALYSIS   12

Frequency response, Nyquist stability criterion, Nyquist plot and determination of closed loop stability, definition of gain margin and phase margin, Bode plot, determination of gain margin and phase margin using Bode plot, use of Nichol's chart to compute response frequency and bandwidth.

UNIT V   PHYSIOLOGICAL CONTROL SYSTEM   12

Example of physiological control system, difference between engineering and physiological control systems, generalized system properties, models with combination of system elements, linear models of physiological systems-Examples, introduction to simulation.

L : 60   T: 0   P: 0   Total: 60 PERIODS

TEXT BOOKS
1. M. Gopal "Control Systems Principles and Design", Tata McGraw Hill, 2002
2. Michael C K Khoo, "Physiological Control Systems", IEEE Press, Prentice Hall of India, 2001

REFERENCES
1. Benjamin C. Kuo, "Automatic Control Systems", Prentice Hall of India, 1995.
2. John Enderle Susan Blanchard, Joseph Bronzino "Introduction to Biomedical Engineering", Second Edition, Academic Press, 2005.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Identify various models and find their transfer function
CO2   Analyze the given system's time response
CO3   Determine the stability of given system
CO4   Analyze the given system's frequency response
CO5   Analyze Physiological control system

16GE212   **CAREER DEVELOPMENT PROGRAMME IV**   **L   T   P   C**

(Common to all B.E. / B. Tech. Courses)   **1   0   2   2***

UNIT I   COMMUNICATION & SOFT SKILLS   7

Group Discussion – Types, guidelines, roles, Do's and Don'ts during GD, Mock GD. Interview Etiquettes – Meaning, Purpose, Interview Process and Types, Checklist – Do's and Don'ts, Preparation of Self Introduction.

UNIT II   LINGUISTIC SKILLS IV   15

Cloze test, Direct & Indirect speech, Question Tags, Homonyms, HIGH LEVEL- Synonyms, Antonyms, Idioms and Phrases.

UNIT III   VERBAL REASONING - III   7

Logical reasoning - Machine Input & Output, Coded Inequalities, Puzzles, Cubes, Data sufficiency, Analogy.

UNIT IV   VERBAL &NON VERBAL REASONING - IV   8

Critical reasoning-   Statement – Argument & Assumption, Courses of Action, Inferences.

Non Verbal reasoning- Insert the missing character, Figure series, Odd man out, Cubes & Dices, Logical Venn diagram.

UNIT V   PRACTICALS   8

Group Discussion, Online typing, Mock Interview, Company website references.

L:15   T:0   P:30   Total: 45 PERIODS

TEXT BOOKS
1   Barun K. Mithra, "Personality Development & Soft Skills", Oxford, 2006.
2   S.P.Bakshi, "Objective English" Arihant Publications, 2014.

REFERENCES
1   Dr. R.S.Agarwal, "A modern approach to Verbal & Non-verbal Reasoning", S.Chand & Company Pvt Limited, 2013.
2   S.P.Bakshi, "Objective English" Arihant Publications, 2014.
3   Dr. Aggarwal R.S and Monika Agarwal, "Objective General English", New Delhi, Sultan Chand and Company Ltd., 1999.
4   Arun Sharma & Meenakshi Upadhay,"Verbal ability and Reading comprehension".Mc Graw Hill Education.
5   Dutt Kiranmai.P, Rajeevan Geethe & Prakash C.L.N 'A course in Communication Skills ,First publications Cambridge University Press India Pvt.Ltd , 2008.

COURSE OUTCOMES
At the end of the course students should be able to
CO1   Bring behavioral changes through interview etiquettes & communicate well.
CO2   Improve their thinking ability.
CO3   Solve the puzzles through their lateral thinking ability.
CO4   Think critically and attain solutions for the problems.
CO5   Speak better in GD and thorough with the company details.

16GE214   **CAREER DEVELOPMENT PROGRAMME IV**   **L   T   P   C**
                  (Common to all B.E. / B. Tech. Courses)   **1   0   2   2***

UNIT I   BODY LANGUAGE   9

Body Language – Introduction, Elements, Grooming, Body Language –Postures and Gestures, Dressing Etiquette, Hygiene and Cleanliness, Time Management, Body Language - Positive and Negative ,Importance of body language in Communication.

UNIT II   INTERVIEW ETIQUETTE   9

Interview Etiquettes – Meaning, Purpose, Process, Types, Do's and Dont's, Dress Code, Self Introduction, Code of Conduct for Interviews, Mock Interview

UNIT III   RESUME BUILDING   9

Resume Building –Introduction, difference between Resume and CV, Strategy of resume writing, Body of the resume, clarity and crispness, format and content, Resume Etiquettes – Do's and Dont's, model resume writing.

UNIT IV   GROUP DISCUSSION   9

Group Discussion – Types, Key steps to succeed in GD, Skills required for GD, Importance of GD, Guidelines – Do's and Dont's during GD, the technique of Summing up, Mock GD.

UNIT V   PRACTICALS   9

Extempore Speech, Company website References, Short speech.

L:15   T:0   P:30   Total: 45 PERIODS

TEXT BOOKS

1   John Eastwood, "Oxford Practice Grammar", Oxford.
2   Barun K. Mithra, "Personality Development & Soft Skills", Oxford.

REFERENCES

1   Sanjay Kumar "Communication Skills", Oxford University 2015.
2   Sanjay Kumar "Communication Skills", Oxford University 2015.
3   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication, 2012.
4   Dr. Aggarwal R.S and Monika Agarwal, "Objective General English", New Delhi, Sultan Chand and Company Ltd., 1999.
5   Arun Sharma & Meenakshi Upadhay,"Verbal ability and Reading comprehension".Mc Graw Hill Education.

COURSE OUTCOMES

At the end of the course students should be able to

CO1   Exhibit appropriate body language and interview skills.
CO2   Speak effectively in group discussion and acquire interpersonal skills.
CO3   Acquire the professional skills of Group discussion and Resume writing.
CO4   Improve thinking, listening and speaking skills.
CO5   Demonstrate an understanding of the principles of active listening.

16BM243   **PATHOLOGY AND MICROBIOLOGY LABORATORY**   **L   T   P   C**

                                                              0   0   2   1

LIST OF EXPERIMENTS

1. Urine physical and chemical examination
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumors
4. Simple stain.
5. Gram stain
6. AFB stain
7. Bleeding time
8. Clotting time
9. Haematology slides of anemia and leukemia
10. Study of bone marrow charts
11. Manual paraffin tissue processing and section cutting (demonstration)
12. Cryoprocessing of tissue and cryosectioning (demonstration)

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Wax dispenser
- Slide warming
- Microtome
- Microscope Micro photographic unit
- Slides
- Cover slip
- Distillation Unit
- Water bath normal
- Incubator
- Autoclave
- Oven

L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
- **CO1**   Get hands on experience on compound microscope
- **CO2**   To acquire knowledge on staining process.
- **CO3**   Gain knowledge on bleeding and clotting time
- **CO4**   Acquire knowledge on bone marrow
- **CO5**   Familiar with the concepts of hematology slides of anemia and leukemia

16BM244 **BIOMEDICAL SENSORS & INSTRUMENTS LABORATORY** **L T P C**

0 0 2 1

LIST OF EXPERIMENTS

1. Characteristics of Strain Gauge.
2. Measurement of displacement using capacitive transducer and LVDT.
3. Characteristics of RTD, Thermistor and Thermocouple.
4. Characteristics of optical transducer for SpO2 measurement
5. Measurement of skin temperature by both contact and non-contact method
6. Data acquisition of physiological signals
7. Measurement of Respiration rate and pulse rate.
8. Measurement of Blood Pressure
9. Measurement of pH.
10. Non-invasive gas analyzer as an electronic nose.
11. Study of CRO and DSO
12. Study of Recorders

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Strain Gauge and Load Cell kit
- Loads for measurement
- LVDT trainer kit
- Thermistor trainer kit
- RTD, Thermistor and Thermocouple
- Optical transducer trainer kit
- Respiration rate and pulse rate kit
- Blood Pressure kit
- pH trainer kit
- Non-invasive gas analyzer

L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
- **CO1**   Acquire practical knowledge about the transducers.
- **CO2**   Gain knowledge about transducers used for biomedical measurements.
- **CO3**   Get hands on experience on acquisition of physiological signals.
- **CO4**   Get a theoretical exposure of anemometers, amperometric sensors
- **CO5**   Appreciate the use of non-invasive gas analyzer as an electronic nose

LIST OF EXPERIMENTS

1. Study of logic gates, Half adder and Full adder
2. Encoder and BCD to 7 segment decoder
3. Multiplexer and demultiplexer using digital ICs
4. Universal shift register using flip flops
5. Design of mod-N counter
6. Inverting, non-inverting amplifier and comparator
7. Integrator and Differentiator
8. Active filter – first order and second order LPF and HPF
9. Current to Voltage convertor and Voltage to Current Convertor
10. Comparator, Peak detector and Average detector
11. Instrumentation amplifier using IC741
12. Wein bridge oscillator
13. Multivibrator using IC555 Timer
14. Phase Locked Loop
15. A/D Convertor
16. D/A Converter

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- CRO
- Function Generator
- RPS (0 – 30)V
- Multimeter
- IC – 741
- IC – 555
- Logic Gate ICs
- Digital Trainer Kit
- Flip Flop IC 7476

L : 0   T: 0   P: 60   Total:60 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Acquire knowledge in designing combinational and sequential logic circuits
CO2   Gain knowledge in designing various circuits using linear ICs
CO3   Get exposed to designing circuits for generating waveforms using ICs
CO4   Design multivibrators using Timer IC.
CO5   Design Converters using PLL

16GE301	PROFESSIONAL ETHICS	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	3

UNIT I   ENGINEERING ETHICS   9

Senses of Engineering ethics – Variety of moral issues – Types of inquiry- Moral dilemmas. Moral autonomy – Kolberg's theory – Gilligan's theory – consensus and controversy – professions and professionalism – professional ideals and virtues – theories about right action – self-interest – customs and religion – use of ethical theories.

UNIT II   ENGINEERING AS SOCIAL EXPERIMENTATION   9

Engineering as social experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – Case studies.

UNIT III   ENGINEERS RESPONSIBILITY FOR SAFETY   9

Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk – Case studies.

UNIT IV   RESPONSIBILITIES AND RIGHTS   9

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest –occupational crime – professional rights –employee right – discrimination – intellectual property rights, Case studies.

UNIT V   GLOBAL ISSUE   9

Multinational corporations – environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – sample code of conduct, Case studies.

L:45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw hill, NewYork, 2004.
2. Govindarajan. M, Natarajan. S,Senthilkumar. V.S, "Engineering Ethics" Prentice Hall, New Delhi, 2004.

REFERENCES
1   Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics– Concepts and Cases", Cengage Learning, 2009 .
2   Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt.Ltd., New Delhi 2013 .
3   Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4   Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004).
5   David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories.
CO2   Identify various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
CO3   Realize the responsibilities of an engineer for safety and risk benefit analysis.
CO4   Recognize the professional rights and responsibilities of an engineer.
CO5   Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional career.

16BM301   **DIAGNOSTIC AND THERAPEUTIC EQUIPMENT- I**   L   T   P   C
                                                                        3   0   0   3

UNIT I   CARDIAC EQUIPMENT   9
Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, Plethysmography. Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External.

UNIT II   NEUROLOGICAL EQUIPMENT   9
Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential–Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation

UNIT III   SKELETAL MUSCULAR EQUIPMENT   9
Generation of EMG, recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT IV   PATIENT MONITORING AND BIOTELEMETRY   9
Patient monitoring systems, ICU/CCU Equipments, Infusion pumps, bed side monitors, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission

UNIT V   EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC   9
                  TECHNIQUES
Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenerators, finger pump, roller pump, electronic monitoring of functional parameter. Hemo Dialyser unit, Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy. Thermography – Recording and clinical application, ophthalmic instruments.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
   1   Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.
REFERENCES
   1   Myer Kutz, "Standard Handbook of Biomedical Engg & Design", Mc Graw Hill, 2003
   2   L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008
   3   Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007
   4   Antony Y.K.Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.
   5   Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2004.
COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Use different medical devices applied in measurement of parameters related to cardiology, neurology
CO2   Explain about cardiac assist devices, its continuous monitoring and transmission
CO3   Measure signals generated by muscles
CO4   Explain need and use of some of the extracorporeal devices
CO5   Distinguish the diagnostic techniques

16EI301	PIC MICROCONTROLLERS AND ARM PROCESSOR	L	T	P	C
		3	0	1	4

UNIT I   PIC MICROCONTROLLER   9+3

Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation. Implementation using MPLAB: Arithmetic and logical operations, Addressing modes

UNIT II   PERIPHERAL INTERFCAING OF PIC MICROCONTROLLER   9+3

Timers – Interrupts, I/O ports- I2C bus- ADC, DAC and Sensor Interfacing - Interfacing LCD Display – Keypad Interfacing -UART- CCP modules -Flash and EEPROM memories Implementation using MPLAB: I/O Configuration and DAQ (Sensor Interfacing) , Interfacing ADC for LCD display, Interfacing DAC to RELAY , Interfacing KEYPAD

UNIT III   ARM ARCHITECTURE   9+3

ARM Architecture- ARM programmer‟s model - Addressing modes- instruction set-Data processing instructions, Data transfer instructions, ARM Condition codes, Branches, Software interrupt (SWI), Multiply instructions-ARM Assembly Language programming .

UNIT IV   PERIPHERAL INTERFCAING OF ARM PROCESSOR   9+3

Timer – UART –interrupt structure – ADC AND DAC Interfacing keyboard Interface, LCD interface, on chip ADC/DAC interface. Implementation using Keil: Interfacing ADC for LCD display, Interfacing DAC to RELAY , Interfacing KEYPAD

UNIT V   APPLICATIONS   9+3

ARM Processor based Real-time Car Theft Decline System -ARM Processor based Drunken People Identification With Auto Ignition Disable Function-Design and Implementation of Automatic Turn off for Water Pump with Four Different Time Slots using ARM Processor-ARM Cortex (STM32) based Solar Street Light

L : 45   T: 0   P:15   Total: 60 PERIODS

TEXT BOOKS

1. Muhammad Ali Mazidi, Rolin D. Mckinlay,Danny Causey "PIC Microcontroller and Embedded systems using Assembly and C for PIC18" , Pearson Education 2008
2. Andrew Sloss, Dominic systems and chris wright, "ARM System Developers guide designing and optimizing system", Elsevier India private limited, New Delhi, 2009

REFERENCES

1. Dr. Jonathan W. Valvano, "Embedded Systems: Introduction to ARM Cortex-M Microcontrollers",2012
2. A.K.Ray & K.M Bhurchandi, „Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing‟, Tata Mc Graw Hill, 2006.
3. Yn-cheng Liu,Glenn A.Gibson, „Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design‟ , 2nd Edition, Prentice Hall of India , 2006
4. Michael J. Pont, „Embedded C‟, Addison Wesley, 2002.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Understand the architecture of PIC microcontroller and perform basic arithmetic & logical operations in MP LAB

CO2   Interface PIC microcontroller with I/O devices and implement them in MP LAB

CO3   Acquire Knowledge of ARM Processor and implement logic operations in Keil

CO4   Interface ARM Processor with the I/O devices and implement in Keil.

CO5   Develop programs for real time applications using ARM Processor

16CS451	**OBJECT ORIENTED PROGRAMMING USING C++**	**L**	**T**	**P**	**C**
	(Common to ECE,MCT, EEE & EIE)	**3**	**0**	**0**	**3**

UNIT I INTRODUCTION 9

Need for object oriented programming – Procedural Languages vs. Object oriented approach – Characteristics Object oriented programming – C++ Programming Basics: Basic Program Construction – Output Using cout – Input with cin – Data types – Variables and Constants – Operators – Control Statements-Manipulators-Type conversion.

UNIT II OBJECTS AND CLASSES 9

Simple Class – C++ Objects as Physical Objects – C++ Object as Data types – Constructors and Destructors – Object as Function Arguments – Returning Objects from Functions – Structures and Classes – Arrays and Strings.

UNIT III OPERATOR OVERLOADING AND INHERITANCE 9

Need of operator overloading – Overloading Unary Operators – Overloading binary Operators – Overloading Special Operators – Data Conversion – Inheritance: Derived Class and Base Class – Derived Class Constructors – Overriding Member Functions-Class Hierarchies – Public and Private Inheritance – Levels of Inheritance – Multiple Inheritance.

UNIT IV POLYMORPHISM AND FILE STREAMS 9

Virtual Function – Friend Function – Static Function-Assignment and Copy Initialization – Streams – String I/O – Character I/O – Object I/O – I/O with Multiple Objects – File Pointers – Disk I/O with Member Functions – Error Handling in File I/O.

UNIT V TEMPLATES AND EXCEPTION HANDLING 9

Templates: Introduction – Function Templates – Overloading Function Templates – Class Templates – Exception Handling – Syntax, multiple exceptions, exceptions with arguments.

L : 45   T: 0   P: 0   J: 0   Total: 45 PERIODS

TEXT BOOKS
1 Robert Lafore, Object Oriented Programming in-C++, Galgotia Publication, 2009.
2. Deitel & Deitel, "C++ How to program", Prentice Hall,2005.

REFERENCES
1 D.S.Malik, "C++ Programming", Thomson, 2007.
2 K.R. Venugopal, Rajkumar and T.Ravishankar, "Mastering C++", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2006.
3 Balagurusamy, "Object Oriented Programming with C++", Sixth Edition,McGraw Hill Education ,2013.
4 Joyce Farrell ,"Object-Oriented Programming Using C++", Fourth Edition,2008.
5 Subhash K U, "Object Oriented Programming With C++", First Edition, Pearson Education,2010.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Determine the needs of object oriented programming.
CO2 Differentiate the functionalities of object oriented approach and procedural languages.
CO3 Demonstrate the concept of operator overloading and inheritance.
CO4 Demonstrate the concepts of polymorphism and file streams.
CO5 Develop create templates and handle exceptions.

16BM311	**CAREER DEVELOPMENT PROGRAMME V**	L	T	P	C
		3	0	0	2*

UNIT I PHYSIOLOGY 9

Cell, cell potentials, sodium potassium pump, Characteristics of Human Anatomy and Physiology-Electrical Signals and Conductivity, temperature, conduction of action potential in neuron, brain lobes.

UNIT II ELECTRONIC CIRCUITS 9

Introduction to DC and alternating quantities, average and RMS values - mesh and nodal analysis - series and parallel reduction method and analysis, number representations - signed, unsigned, fixed point, floating point numbers - computer codes - BCD, Gray code - error detection and correction codes - parity codes, Hamming codes - Boolean algebra - basic postulates, theorems - switching functions, canonical forms - logic gates.

UNIT III LINEAR ICS 9

Basic Op-Amp circuit - Op-Amp parameters - input and output voltage, CMRR and PSRR, offset voltages and currents, input and output impedances, slew rate and frequency limitations - Op-Amps as DC Amplifiers- biasing Op-Amps, direct coupled - voltage followers, non-inverting amplifiers, Inverting amplifiers, summing amplifiers, difference amplifier.

UNIT IV BIOSENSORS AND TRANSDUCERS 9

Historical perspective - signal transduction - Physico-chemical and biological transducers - sensor types and technologies - terminology and main technical definitions: calibration, selectivity, sensitivity, reproducibility, detection limits, response time - problems and trade-offs

UNIT V BIOMATERIALS 9

Historical developments, definition and classification of biomaterials, construction materials, impact of biomaterials, mechanical properties, wound healing process, tissue response to implants, safety and efficiency testing, bio-compatibility.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

1 Jain A K, "Text book of Physiology", Avichal Publishing Company, New Delhi, 2009.
2 D Roy Choudhury, Shail B Jain, "Linear Integrated Circuits", New age International Publishers, New Delhi, 2009.
3 A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation", 10th edition, Dhanpat Rai& Co, New Delhi, 2010.
4 Sujata V Bhat, "Biomaterials", Narosa Publishing House, New Delhi, 2002.

REFERENCES

1 Morris Mano, "Digital Design", Prentice Hall of India, New Delhi, 2012
2 Ramakant A Gayakwad, "Op - Amps and Linear Integrated Circuits", PHI Learning Private Limited, New Delhi, 2009
3 William D Callister Jr., "Material Science and Engineering", John Wiley and sons, 2006.
4 Charles K Alexander "Fundamentals of Electric Circuits", Tata McGraw Hill, New Delhi, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Describe basic structural and functional elements of human body
CO2 Apply the elementary concept of electric sources, elements and their properties in the circuits
CO3 Understand the basic of the Digital systems
CO4 Describe the purpose and methods of measurements
CO5 Analyze different types of Biomaterials and its classification

16GE313	CAREER DEVELOPMENT PROGRAMME V	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	1	0	2	2*

UNIT I   QUANTITATIVE ABILITY I   9

Number theory- Shortcuts, Divisibility criteria- Unit place deduction-LCM &HCF, Square root and Cube Root, Decimal & Fraction, Percentage.

UNIT II   QUANTITATIVE ABILITY II   9

Profit, loss and discount, Simple and compound interest, Ratio & Proportions, Mixtures & Allegation, Partnership.

UNIT III   QUANTITATIVE ABILITY III   9

Problems on Ages, Average, Venn diagram, Clocks, Calendar, Data Interpretation- Bar chart- Pie chart- Line chart-Tables chart.

UNIT IV   VERBAL REASONING I   9

Analytical reasoning - Linear, Circular & Complex arrangement, Blood relation, Direction Problems, Puzzle.

UNIT V   VERBAL REASONING II   9

Logical reasoning - Number and Alpha series, Odd man out, Element series, Logical series, Coding and decoding, Analogy, Alphabets, Logical sequence of words.

L : 15   T:0   P:30   Total: 45 PERIODS

TEXT BOOKS
1   Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.
2   BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.

REFERENCES
1   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
2   R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited
3   M.K.Panday, "Analytical Reasoning", Magical Series.
4   Wiley's Quantitative Aptitude Book - P.A. Anand.
5   The Pearson Guide To Quantitative Aptitude For Competitive – Arun Sharma.

COURSE OUTCOMES
At the end of the course students should be able to
CO1   Know the both analytical and logical reasoning
CO2   Apply the shortcut methods in quantitative aptitude.
CO3   Solve application orientated concepts in quantitative aptitude.
CO4   Improve the quality of the student as a finished product for their corporate life.
CO5   Understand and practice Logical reasoning.

16BM341   **DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – I**   **L   T   P   C**
LABORATORY

                                                              0   0   2   1

LIST OF EXPERIMENTS

1. Design and analysis of biological pre amplifiers
2. Recording of ECG signal and analysis
3. Recording of EMG-Signal
4. Recording of EEG-Signal
5. Recording of various physiological parameters using patient monitoring system and telemetry units.
6. Measurement of pH and conductivity.
7. Measurement and recording of peripheral blood flow
8. Measurement of visually evoked potential.
9. Study of characteristics of optical Isolation amplifier
10. Galvanic skin resistance (GSR) measurement

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Biological Pre-amplifier
- ECG recorder
- EEG Recorder
- EMG Recorder
- Multi Parameter Patient Monitoring System
- Telemetry
- pH Meter
- Conductivity Meter
- Blood flow measurement system using ultrasound transducer
- Optical isolation amplifier
- Visually evoked potential
- GSR measurement setup
- DSO

                                      L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:

CO1	Acquire practical knowledge about the biosignals.
CO2	Gain knowledge about amplifiers used for biomedical measurements.
CO3	Get hands on experience on acquisition of physiological signals.
CO4	Get an exposure of patient monitoring system
CO5	Appreciate the use of non-invasive blood flow measurement

16EI320	**PIC MICROCONTROLLERS AND ARM PROCESSOR LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

LIST OF EXPERIMENTS

1. LED Blinking using PIC controller (16F877A) with MPLAB
2. To display a message on LCD using PIC controller
3. Interfacing ADC to display analog to digital conversion values on LCD
4. Interfacing KEYPAD to display value on LCD when a key is pressed.
5. To display message in 7segment
6. Interfacing GSM modem to send and receive the message
7. Interfacing Bluetooth module
8. Interfacing Zigbee Module
9. Interfacing RELAY to turn the relays ON and OFF
10. Display a message using I2C Protocol
11. Traffic light controller – Two lane
12. Traffic light controller – Four lane

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- PIC MC Trainer Kit
- APRM 7 Processor Kit
- 12 V Power Supply
- Zigbee Module
- Ardiuno Kit
- 4x4 LCD Display
- Connection Pin
- RS 232 Cable
- Wi-Fi Module
- Keyboard

L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:

CO1	Understand the architecture of PIC microcontroller
CO2	Interface PIC microcontroller with I/O devices
CO3	Acquire Knowledge of ARM Processor
CO4	Interface ARM Processor with the I/O devices and implement in Keil.
CO5	Develop programs for real time applications using ARM Processor

16CS452   **OBJECT ORIENTED PROGRAMMING USING**   **L   T   P   C**
C++LABORATORY
(Common to ECE,MCT, EEE & EIE)   **0   0   4   2**

LIST OF EXPERIMENTS

1. Define a class to represent a bank account to include the following members.
    Data Members: Name of the depositors, Account number, Type of account, Balance amount in the account.
    Member functions:
    To initialize values to data members
    To deposit an amount
    To withdraw an account after checking the balance
    To display the name and the balance
    Note: Try to use all types of constructors
2. Apply function overloading and operator overloading to the given problems.
3. Implement the concept of default argument function.
4. Implement the concept of array of objects.
5. Apprehend a class with dynamic objects and use constructors and destructors.
6. Execute the concept of Inheritance.
7. Illustrate the use of static data member and static member functions by keeping track of number of instances of object that are created and alive.
8. Implement friend functions and friend classes to add the private data member of two different classes.
9. Exercise the file handling concepts Copy the content of one file to another file by removing unnecessary spaces between words.
10. Realize the following concepts:
    (i) Class templates and Function templates
    (ii) Exception Handling
11. Design Experiments.
12. Application Oriented Experiments: Mini Project.

MAJOR EQUIPMENTS / SOFTWARE REQUIRED
Hardware
- PC – 30 nos.
- Processor – 2.0 GHz or higher
- RAM – 256 MB or higher
- Hard disk – 20 GB or higher
- OS- Windows 2000/ Windows XP/ NT

Software
Turbo C (freeware) – to be installed in all PC's.

L : 0   T: 0   P: 60   Total:60 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Strengthen the problem solving ability by applying the characteristics of an object-oriented approach.
CO2   Implements fundamental constructs of OOP- classes, objects friend function, inline functions and dynamic programming.
CO3   Apply critical thinking skills and creativity to solve the problems.
CO4   To design and implement object oriented software to solve moderately complex problems.

CO5   Develop application using OOP concepts

16BM321	**RADIOLOGICAL EQUIPMENT**	L	T	P	C
		3	0	0	3

UNIT I   MEDICAL X-RAY EQUIPMENT   9

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.

UNIT II   COMPUTED TOMOGRAPHY   9

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors-Viewing systems- spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques- back projection and iterative method.

UNIT III   MAGNETIC RESONANCE IMAGING   9

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV   NUCLEAR MEDICINE SYSTEM   9

Radio Isotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera- Principle of operation, collimator, photo multiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET.

UNIT V   RADIATION THERAPY AND RADIATION SAFETY   9

Radiation therapy–linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters - electronic dosimeter- Radiation protection in medicine- radiation protection principles.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia, 1988
2. R.Hendee and Russell Ritenour "Medical Imaging Physics", Fourth Edition William, Wiley-Liss, 2002.

REFERENCES
1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine"- Third edition Springer, 2006.
2. B.H.Brown, PV Lawford, R H Small wood , D R Hose, D C Barber, "Medical physics and biomedical Engineering", - CRC Press, 1999.
3. Myer Kutz, "Standard handbook of Biomedical Engineering and design", McGraw Hill, 2003.
4. P.Ragunathan, "Magnetic Resonance Imaging and Spectroscopy in Medicine

COURSE OUTCOMES
At the end of the course student should be able to:
CO1	Explain the different therapeutic techniques
CO2	Understand generation of x-rays and its uses in imaging.
CO3	Explain different types of radio diagnostic techniques.
CO4	Know techniques used for visualizing different sections of the body.
CO5	Radiation therapy methodologies and the radiation safety.

16BM322   **DIAGNOSTIC AND THERAPEUTIC EQUIPMENT- II**   L   T   P   C
                                                                          3   0   0   3

UNIT I   RESPIRATORY MEASUREMENT STSTEM   9
Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, pneumotachometer – Airway resistance measurement, Whole body plethysmography, Intra-Alveolar and Thoracic pressure measurements, Apnea Monitor. Types of Ventilators – Pressure, Volume, time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT II   NEUROLOGICAL EQUIPMENT   9
Psycho Physiological Measurements-for testing and sensory Responses, Electro occulograph, Electro retinograph, Audiometer-Pure tone, Speech. EGG (Electrogastrograph), galvanic skin resistance (GSR).

UNIT III   DIATHERMY   9
IR and UV lamp and its application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.

UNIT IV   ULTRASONIC TECHNIQUE   9
Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques A, B and M mode, B Scan, Application of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynecology, ophthalmology.

UNIT V   PATIENT SAFETY   9
Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient's electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – Basic Approaches to Protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system

                                         L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
  1   Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.
REFERENCES
  1   Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007
  2   John G.Webster, "Medical Instrumentation Application and Design", third edition, JohnWiley and Sons, New York, 2006.
  3   Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2004.
  4   Richard Aston "Principles of Biomedical Instrumentation and Measurement", Merril Publishing Company, 1990.

COURSE OUTCOMES
At the end of the course student should be able to:
  CO1   Explain about measurements of parameters related to respiratory system
  CO2   Describe the measurement techniques of sensory responses
  CO3   Analyze different types and uses of diathermy units
  CO4   Discuss ultrasound imaging techniques and its usefulness in diagnosis
  CO5   Outline the importance of patient safety against electrical hazard

16BM323   **BIOMEDICAL SIGNAL PROCESSING**   **L   T   P   C**
                                                                   3   0   2   4

UNIT I   BIOSIGNALS AND THEIR CHARACTERISTICS   9+6
Source of Bioelectric potential, Resting and action potential, Propagation of action potentials in nerves, Characteristics of biomedical signals, The ECG—Cardiac electrophysiology, relation of ECG components to cardiac events, clinical applications.
MATLAB: ECG signal acquisition and representation, ECG display and heart beat detection.

UNIT II   TRANSFORMS   9+6
Sampling theorem - ECG signal conversion system- - Discrete Fourier Transform (DFT)-Fast Fourier Transform (FFT): Radix-2, decimation in time and frequency algorithms, Short Time Fourier Transform (STFT), wavelet Transform.
MATLAB: Perform transforms on ECG, EEG and EMG and analyze the frequency response, ECG QRS detection

UNIT III   BASICS OF FIR FILTER   9+6
Structures of FIR, Linear phase FIR filter, FIR filter design using window method- LPF- HPF- BPF-BEF, Basics of integer filter and Signal Averaging, Concepts of Adaptive filtering.
MATLAB: FIR filter design using hanning and hamming window for noise removal, integer filter for ECG Analysis, Adaptive filters and signal Averaging.

UNIT IV   BASICS OF IIR FILTER   9+6
Analog IIR filter design, IIR filter design by Impulse Invariance, Bilinear Transformation method, Digital IIR filters design using Butterworth polynomial- LPF- HPF- BPF-BEF
MATLAB: IIR filter design for noise removal in ECG signal.

UNIT V   DATA REDUCTION TECHNIQUES AND ECG QRS DETECTION   9+6
Turning point algorithm, AZTEC algorithm, CORTES algorithm, Fan algorithm, Huffman algorithm.
MATLAB: Data compression using Turning point, AZTEC, CORTES & FAN Algorithm.

                              L : 45   T: 0   P: 30   Total: 75 PERIODS

TEXT BOOKS
1. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc GrawHill, 2007.
2. Tompkins W.J, "Biomedical Digital Signal Processing", Prentice Hall, New Delhi, 1995
3. S.Poornachandra, B.Sasikala, "Digital Signal Processing", Tata McGraw-Hill Education, 2010.

REFERENCES
1. Rangaraj M Rangayyan "Biomedical Signal Analysis: A Case-Study Approach", Wiley India, New Delhi, 2004
2. Oppenheim A.V et.al. , "Discrete Time Signal Processing", Prentice Hall India, NewDelhi,1999
3. Guyton AC, "Human Physiology", Prism International, 1991.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Apply DFT for the analysis of digital signals & systems
CO2 Design IIR and FIR filters
CO3 Characterize finite Word length effect on filters
CO4 Design the Multirate Filters
CO5 Apply Adaptive Filters to equalization

16BM324	BIOMEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	2	4

UNIT I   DIGITAL IMAGE FUNDAMENTALS   9+6

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models

MATLAB: Image sampling and quantization

UNIT II   IMAGE ENHANCEMENT   9+6

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters

MATLAB: Analysis of spatial and intensity resolution of images.

UNIT III   IMAGE RESTORATION AND SEGMENTATION   9+6

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Morphological processing- erosion and dilation.

MATLAB: Edge detection, line detection and point detection

UNIT IV   WAVELETS AND IMAGE COMPRESSION   9+6

Wavelets – Subband coding - Multiresolution expansions - Compression**:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

MATLAB: Histogram Processing

UNIT V   IMAGE REPRESENTATION AND RECOGNITION   9+6

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

MATLAB: Analysis of images with different color models.

L : 45   T: 0   P:30   Total: 75 PERIODS

TEXT BOOKS

1   Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

REFERENCES

1   Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
2   Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
3   Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Discuss digital image fundamentals
CO2   Apply image enhancement and restoration techniques
CO3   Use image compression and segmentation techniques
CO4   Represent features of images
CO5   Implementation image processing using MATLAB

16GE312	CAREER DEVELOPMENT PROGRAMME VI	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	1	0	2	2*

UNIT I   LINGUISTIC SKILLS   10

Parts of Speech, Sentences - Simple, Compound & Complex sentences, Logical sequence of words, Reading Comprehension, Paragraph writing, Jumbled words, Jumbled sentences, Error Spotting, Idioms & Phrases, Word Substitution, Synonyms & Antonyms.

UNIT II   QUANTITATIVE ABILITY   10

Number theory, Percentage, Profit loss and discount, Simple and compound interest, Problems on Average & Ages, Ratio & Proportions, Partnership, Mixtures and allegation, Time speed and distance, Time and work, Probability, Permutation and combination, Mensuration, Clocks, Calendars.

UNIT III   VERBAL & NON-VERBAL REASONING   10

Analytical reasoning - Linear, Circular & Complex arrangement, Blood relation, Direction Problems, Decision making.

Logical reasoning - Number and Alpha series, Odd man out, Element series, Logical series, Coding and decoding, Syllogisms, Alphabets Machine Input & Output Coded Inequalities, Puzzles, Cubes, Data sufficiency, Analogy.

Critical reasoning - Statement – Argument & Assumption, Causes & effects, Courses of Action, Inferences.

Non-Verbal reasoning - Insert the missing character, Figure series, Cubes & Dices, Logical Venn diagram.

UNIT IV   PERSONALITY DEVELOPMENT & SOFT SKILLS   8

Body Language – Introduction, Grooming, Body Language - Postures and Gestures, Dressing Etiquettes, Hygiene & Cleanliness, Time Management

Interview Etiquettes – Meaning, Purpose, Interview process and types, checklist – do's and don'ts, Dress code, Self-Introduction.

Resume Building – Introduction, transformation between Resume and CV, Strategy of Resume Writing, Body of the resume, clarity and crispness, format and content.

Group Discussion – Types, Key steps to succeed in Group Discussion, Guidelines – Do's and Don'ts during Group Discussion, the technique of summing up.

UNIT V   COMPANY SPECIFIC TRAINING   7
Company specific training.

L:15   T:0   P:30   Total: 45 PERIODS

TEXT BOOKS
  1   John Eastwood, "Oxford Practice Grammar", Oxford.
  2   Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCES
  1   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
  2   R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt limited.
  3   S.P.Bakshi, "Objective English" Arihant Publications.
  4   Edgar Thorpe & Showick Thorpe, "Winning Interviews", Pearson Publications.
  5   M.K.Panday, "Analytical Reasoning", Magical Series.

COURSE OUTCOMES
At the end of the course students should be able to
CO1   Communicate well both in oral and written English.
CO2   Solve the complicated problems with the thorough knowledge on the basics.
CO3   Think both critical and logical to solve the problems.
CO4   Be a better personality in their professional and social life.
CO5   Face the recruitment challenges.

16GE314   **CAREER DEVELOPMENT PROGRAMME VI**   L   T   P   C
                (Common to all B.E. / B. Tech. Courses)   1   0   2   2*

UNIT I   QUANTITATIVE ABILITY IV   9

Time, speed & distance-Average speed- Relative speed- Train problems- Boats and streams- Races, Chain rule, Time and work -Pipes and cisterns.

UNIT II   QUANTITATIVE ABILITY V   9

Permutation & Combination, Probability, Mensuration, Data sufficiency (Quants).

UNIT III   VERBAL REASONING   III   9

Machine Input and Output, Coded Inequalities, syllogisms, Problems on Cubes, Data sufficiency (Reasoning).

UNIT IV   CRITICAL REASONING   9

Statement and Argument, Statement and Assumption, Statement and Conclusion, Course of action, Inference, Decision Making.

UNIT V   NON- VERBAL REASONING   9

Figure series, Odd man out, Mirror Image, Water image, Embedded Image, Cubes and Dices, shape construction, Insert the Missing Characters, Analytical reasoning, Logical venn diagram.

L:15   T:0   P:30   Total: 45 PERIODS

TEXT BOOKS
1   Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.
2   BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
REFERENCES
1   R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
2   R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited.
3   M.K.Panday, "Analytical Reasoning", Magical Series.
4   Wiley's Quantitative Aptitude Book - P.A. Anand.
5   The Pearson Guide To Quantitative Aptitude For Competitive – Arun Sharma.
COURSE OUTCOMES
At the end of the course students should be able to
CO1   Increase the students knowledge in both analytical and logical reasoning
CO2   Apply the shortcut methods in quantitative Aptitude
CO3   Solve application orientated concepts in quantitative aptitude.
CO4   Improve the quality of the student as a finished product for their corporate life
CO5   Use their logical thinking and analytical abilities to solve Quantitative aptitude questions.

DIAGNOSTIC AND THERAPEUTIC EQUIPMENT -II   **L   T   P   C**
LABORATORY

                                          0   0   2   1

LIST OF EXPERIMENTS

1. Simulation of ECG – detection of QRS complex and heart rate
2. Study of shortwave and ultrasonic diathermy
3. Study of biotelemetry
4. Electrical safety measurements
5. Measurement of Respiratory parameters using spirometry
6. Study of medical stimulator
7. Study of ESU – cutting and coagulation modes
8. Recording of Audiogram
9. Design of ECG amplifier, recording and analysis using LabVIEW

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Short wave Diathermy
- Ultrasound diathermy
- Single parameter biotelemetry system
- Electrical Safety Analyser
- Spirometry with associated analysis system
- ECG Simulator
- Medical stimulator
- Surgical diathermy with analyzer
- Audiometer
- Short wave Diathermy
- Ultrasound Diathermy

                              L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

 CO1   Acquire practical knowledge about the biosignals.

 CO2   Gain knowledge about amplifiers used for biomedical measurements.

 CO3   Get hands on experience on acquisition of physiological signals.

 CO4   Get an exposure of patient monitoring system

 CO5   Appreciate the use of audiogram

16BM343 **BIOMEDICAL SIGNAL PROCESSING LABORATORY** **L T P C**

0 0 2 1

LIST OF EXPERIMENTS

1. Signal acquisition and representation
2. ECG QRS Detection
3. R-R beat Calculation
4. MAC operation using various addressing modes
5. Linear Convolution
6. Circular Convolution
7. FFT Implementation/ WT
8. Waveform generation
9. IIR and FIR Implementation
10. Finite Word Length Effect of biosignal

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)
- MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems
- DSO

L : 0 T: 0 P: 30 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Apply DFT for the analysis of digital signals & systems

CO2 Design IIR and FIR filters

CO3 Characterize finite Word length effect on filters

CO4 Design the Multirate Filters

CO5 Apply Adaptive Filters to equalization

16BM344   **BIOMEDICAL IMAGE PROCESSING LABORATORY**   **L   T   P   C**

                                                                 0   0   2   1

LIST OF EXPERIMENTS

1. Medical image acquisition and representation
2. MAC operation using various addressing modes
3. Linear Convolution
4. Circular Convolution
5. FFT Implementation
6. IIR and FIR Implementation
7. Finite Word Length Effect of medical image
8. Image enhancement operation on images using spatial filtering.
9. Image enhancement operation on images using frequency domain filtering.
10. Histogram equalization

MAJOR EQUIPMENTS / SOFTWARE REQUIRED
- PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)
- MATLAB with Simulink and Image Processing Tool Box or Equivalent Software in desktop systems

                                          L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
  CO1   Carry out simulation of DSP systems
  CO2   Demonstrate their abilities towards DSP processor based implementation of DSP systems
  CO3   Analyze Finite word length effect on DSP systems
  CO4   Demonstrate the applications of FFT to DSP
  CO5   Implement adaptive filters for various applications of DSP

16GE302 **ENGINEERING ECONOMICS AND COST ANALYSIS** L T P C

(Common to all B.E. / B. Tech. Courses) 3 0 0 3

UNIT I **BASIC ECONOMICS** **9**

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - economies of large and small scale - consumption -wants - its characteristics and classification - law of diminishing marginal utility – relation between economic decision and technical decision.

UNIT II **DEMAND AND SCHEDULE** **9**

Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement – its significance - supply – supply schedule - supply curve - law of supply - elasticity of supply - time element in the determination of value - market price and normal price - perfect competition - monopoly – monopolistic competition.

UNIT III **ORGANISATION** **9**

Forms of business - proprietorship - partnership - joint stock company - cooperative organization - state enterprise - mixed economy - money and banking - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrument.

UNIT IV **FINANCING** **9**

Types of financing - Short term borrowing - Long term borrowing – Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement.

UNIT V **COST AND BREAK EVEN ANALYSES** **9**

Types of costing – traditional costing approach - activity base costing - Fixed Cost – variable cost – marginal cost – cost output relationship in the short run and in long run – pricing practice– full cost pricing – marginal cost pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project profitability –internal rate of return – pay back period – net present value – cost benefit analysis – feasibility reports – appraisal process – technical feasibility economic feasibility – financial feasibility. Break even analysis - basic assumptions – break even chart – managerial uses of break even analysis.

L:45 T: 0 P:0 Total: 45 PERIODS

TEXT BOOKS
1 Dewett K.K. & Varma J.D., Elementary Economic Theory, S Chand & Co., 2006.
2. Sharma JC "Construction Management and Accounts" Satya Prakashan, New Delhi, 2006.

REFERENCES
1 Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age, 2007.
2 Jhingan M.L., Micro Economic Theory, Konark,1989.
3 Samuelson P.A., Economics - An Introductory Analysis, McGraw Hill.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Know the basic terms and concepts of economic.
CO2 Understand the major capability and limitations of cash flow analysis for proposed capital investment.
CO3 Recognize, formulate, analyze and solve cash flow models in practical   situations.
CO4 Develop the ability to account for time value of money using engineering economy factors and formulas, as well as implication and importance of considering taxes, depreciation and inflation.
CO5 Evaluate engineering alternatives by economic analysis techniques and   models.

16BM402	VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL SYSTEM	L	T	P	C
		3	0	0	3

UNIT I   INTRODUCTION   9

General functional description of a digital instrument - block diagram of a virtual instrument - physical quantities and analog interfaces - hardware and software - user interfaces - advantages of virtual instrumentation over conventional instruments - architecture of a virtual instrument and its relation to the operating system.

LabVIEW: Basic arithmetic operations, Boolean operations

UNIT II   G PROGRAMMING   9

Software environment - palettes - data types and colour coding - editing, debugging and running a vi - data flow programming - modular programming - loops - local and global variables.

LabVIEW: Sum of 'n' numbers using 'for' loop, 'While' loop.

UNIT III   PROGRAMMING STRUCTURE   10

Arrays and clusters - sequence structures - plotting data - making decisions in a vi - strings and File I/O - semaphores - TCP/IP - shared variables - data publishing - state machines

LabVIEW: Array maximum and minimum

UNIT IV   HARDWARE OVERVIEW   8

PC architecture: current trends - operating system requirement drivers - interface buses - PCI, PXI and USB buses - interface cards: specifications.

LabVIEW: Application using formula node

UNIT V   DATA AQUISITION   9

Classification of signals - analog and digital interfacing - DAQ hardware and software - configuring the hardware - ADC, DAC, Digital I/O, counters and timers - advanced triggering of audio and video signals - basic system components of a signal conditioning system.

LabVIEW: Instrumentation of an amplifier to acquire an ECG signal using NI vision acquisition software

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Johnson G, Jennings R, "LabVIEW Graphical Programming", Tata McGraw Hill, New York, 2006.
2   Sanjay Gupta, Joseph John, "Virtual Instrumentation using LabVIEW", Tata McGraw Hill, New Delhi, 2010.

REFERENCES
1   Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control", Newnes, 2000.
2   Lab VIEW Basics I &II Manual, National Instruments, 2005.
3   Barry E Paton, "Sensors, Transducers & LabVIEW", Prentice Hall of India, New Delhi, 1999.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Discuss about the Basic concepts of VI
CO2   Understand the programming concepts of VI
CO3   Provide an insight to various Common Instrument Interface
CO4   Enable them to implement VI in medical systems
CO5   Impart knowledge on various analysis tools

16BM411   **VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL**   **L   T   P   C**
SYSTEM LABORATORY

0   0   2   1

LIST OF EXPERIMENTS

1. Basic arithmetic operations
2. Boolean operations
3. Sum of 'n' numbers using 'for' loop
4. Factorial of a give number using for loop
5. Sum of 'n' natural numbers using while loop
6. Factorial of a give number using while loop
7. Sorting even numbers using while loop in an array
8. Array maximum and minimum
9. Bundle and unbundle cluster
10. Flat and stacked sequence
11. Application using formula node
12. Convolution of two signals
13. Windowing techniques

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- PCs with Fixed / Floating point DAQ card (Kit / Add-on Cards)
- LabVIEW Software in desktop systems

L : 0   T: 0   P: 30   Total:30 PERIODS

COURSE OUTCOMES
At the end of the course student should be able to:
 CO1   Discuss about the Basic concepts of VI
 CO2   Understand the programming concepts of VI
 CO3   Provide an insight to various Common Instrument Interface
 CO4   Enable them to implement VI in medical systems
 CO5   Impart knowledge on various analysis tools

16BM412   **HOSPITAL TRAINING**   **L   T   P   C**
                                                                          0   0   4   2

INSTRUCTIONAL OBJECTIVES

1. To enable the students to gather a firsthand experience on usage of various biomedical equipment
2. To be familiar with various medical imaging technique
3. To gain some practical experience in servicing the equipment
4. To get an hands-on experience at site where biomedical equipment are utilized (Hospitals)

L: 0 T: 0 P: 60   Total : 60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Students have to undergo two weeks practical training in biomedical equipment manufacturing companies or hospitals but with approval of the department

CO2   At the end of the training student will submit a report as per the prescribed format to the department

16BM413   **PROJECT PHASE – I**   **L   T   P   C**

                                                                        0   0   4   2

The project involves the following:

1.   Identification of a real life problem in thrust areas

2.   Developing a mathematical model for solving the above problem

3.   Finalisation of system requirements and specification

4.   Proposing different solutions for the problem based on literature survey

5.   Future trends in providing alternate solutions

6.   Consolidated report preparation of the above

                                              L: 0 T: 0 P: 60   Total : 60 PERIODS

16BM414	**PROJECT PHASE – II**	**L**	**T**	**P**	**C**
		0	**0**	**20**	**10**

The project involves the following:

Preparing a project - brief proposal including

1. Problem identification

2. A statement of system / process specifications proposed to be developed (block diagram / concept tree)

3. List of possible solutions including alternatives and constraints

4. Cost benefit analysis

5. Time line of activities

A report highlighting the design finalization [based on functional requirements & standards (if any)

A presentation including the following:

1. Implementation phase (hardware / software / both)

2. Testing & validation of the developed system

3. Learning in the Project

4. Consolidated report preparation

L: 0 T: 0 P: 300   Total : 300 PERIODS

16BM421	BODY AREA NETWORK	L	T	P	C
		3	0	0	3

UNIT I   INTRODUCTION   9

Definition, BAN and Healthcare, Technical Challenges- Sensor design, biocompatibility, Energy Supply, optimal node placement, number of nodes, System security and reliability, BSN Architecture – Introduction

UNIT II   HARDWARE FOR BAN   9

Processor-Low Power MCUs, Mobile Computing MCUs ,Integrated processor with radio transceiver, Memory ,Antenna-PCB antenna, Wire antenna, Ceramic antenna, External antenna, Sensor Interface, Power sources- Batteries and fuel cells for sensor nodes.

UNIT III   WIRELESS COMMUNICATION AND NETWORK   9

RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand –Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1,IEEE P802.15.13, IEEE 802.15.14, Zigbee

UNIT IV   COEXISTENCE ISSUES WITH BAN   9

Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self protection-Bacterial attacks, Virus infection, Secured protocols, Self protection.

UNIT V   APPLICATIONS OF BAN   9

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhymias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1   Annalisa Bonfiglio, Danilo De Rossi ,"Wearable Monitoring Systems", Springer, 2011
2   Sandeep K.S. Gupta, TridibMukherjee, Krishna Kumar Venkatasubramanian, "Body Area Networks Safety, Security, and Sustainability," Cambridge University Press, 2013.

REFERENCES

1   Zhang, Yuan-Ting, "Wearable Medical Sensors and Systems", Springer, 2013.
2   Guang-Zhong Yang (Ed.), "Body Sensor Networks, "Springer, 2006.
3   Mehmet R. Yuce, JamilY.Khan, "Wireless Body Area Networks Technology, Implementation and applications", Pan Stanford Publishing. Ltd, Singapore, 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Explain about working of body area network
CO2   Discuss the applications of body area network
CO3   Discuss the medical device regulation
CO4   Explain the protocol
CO5   Gain knowledge on medical sports

16BM425	ULTRASOUND IN MEDICINE	L	T	P	C
		3	0	0	3

UNIT I   **INTRODUCTION**   **9**

History- Role of Ultrasound in Medical Imaging -Stress And Strain Relationships- Acoustic Wave Equation- Acoustic Properties of Biological Tissues - Doppler Effect. Ultrasound Transducers: Piezoelectric Effect- Properties of Important Piezoelectric Materials- Ultrasonic Transducers- Acoustic Properties of Transducer Materials- Transducer Beam Characteristics

UNIT II   **BIOLOGICAL EFFECTS OF ULTRASOUND**   **9**

Acoustic Phenomena at High-Intensity Levels- Ultrasound Bioeffects- Mechanical Effects and Index.

UNIT III   **GRAY-SCALE ULTRASONIC IMAGING**   **9**

A (Amplitude)-Mode And B (Brightness)-Mode Imaging- Beam Forming- Speckle- Image Quality- M-Mode And C-Mode- Ultrasound Computed Tomography

UNIT IV   **DOPPLER FLOW MEASUREMENTS**   **9**

Nondirectional CW Flow Meters- Directional Doppler Flow Meters- Pulsed Doppler Flow Meters-Clinical Applications And Doppler Indices- Color Doppler Flow Imaging- Elasticity Imaging-Intravascular imaging

UNIT V   **CLINICAL APPLICATIONS**   **9**

Ultrasound Therapy-Hyperthermia- High- Intensity Focused Ultrasound- Lithotripsy-Diagnostic Ultrasound Imaging

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1   K.Shung "Diagnostic Ultrasound: Imaging and Doppler Flow Measurements" Francis & Taylor, CRC Press Boca Raton FL, 2005

2   Szabo. T-Diagnostic Ultrasound Imaging: Inside Out" Elsevier Academic Press, Amsterdam, 2004.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Understand about basic design of medical device.

CO2   Explain the effect of ultrasound in medical device

CO3   Explain different modes of ultrasound imaging

CO4   Analyze the application of Doppler in medical devices

CO5   Detail about system description of therapeutic equipments

16IT420   **SOCIAL NETWORK ANALYSIS**   **L   T   P   C**

                                                                        3   0   0   3

UNIT I   INTRODUCTION TO SOCIAL NETWORK ANALYSIS   9
Introduction to social Networks, Semantic webs - Development of Semantic Web – Emergence of the Social Web - Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis - Electronic discussion networks, Blogs and online communities, Web-based networks

UNIT II   MODELLING, AGGREGATING AND KNOWLEDGE   9
                 REPRESENTATION
Ontology-based Knowledge Representation – Ontology languages for the Semantic Web – RDF and OWL **-** Modelling and aggregating social network data **-** State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III   WEB CONTENT MINING AND LINKAGE MINING   9
Web search- Activities on Web Archiving- web crawling- Personalized Web Search- Latent Semantic Indexing- Automatic topic extraction from Web Documents- Opinion Search and Opinion Spam- Web Search and Hyperlink- Co-citation and Bibliographic Coupling- Page Rank and HITS Algorithms- Web Community Discovery

UNIT IV   WEB USAGE MINING   9
Modelling Web user Interests using Clustering – Probabilistic Latent Semantic Analysis Model-Constructing User Access Pattern and Identifying Latent Factor with PLSA – Co-Clustering analysis of weblogs using Bipartite Spectral Projection Approach

UNIT V   EXTRACTING AND ANALYZING WEB SOCIAL NETWORKS   9
Modeling Web User Interests using Clustering - Types of Changes - Evolution Metrics - Web Archives and Graphs - Evolution of Web Community Charts - Temporal Analysis on Semantic Graph using Three-Way Tensor Decomposition - Analysis of Communities and Their Evolutions in Dynamic Networks

                              L : 45   T: 0   P:0   Total: 45 PERIODS

TEXT BOOKS
 1   Peter Mika, "Social networks and the Semantic Web", Springer, 1st edition 2007.
 2   Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking
     Techniques and applications", Springer, 1st edition, 2011.

REFERENCES
 1   Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010.
 2   Dion Goh and Schubert Foo, "Social information retrieval systems: emerging technologies and
     applications for searching the Web effectively", IGI Global snippet, 2008.
 3   Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and social information retrieval
     and access: techniques for improved user modelling", IGI Global snippet, 2009.
 4   John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

COURSE OUTCOMES
At the end of the course student should be able to:
 CO1   Analyze the development of social networks
 CO2   Become Master in modelling, aggregating and knowledge representation of Semantic Web
 CO3   Evaluate the concepts of web content mining and linkage mining.
 CO4   Know about the usage of web mining in industry standards
 CO5   Understand the concepts of Extracting and Analyzing Web Social Networks

16EE420	**SPECIAL ELECTRICAL MACHINES**	L	T	P	C
		3	0	0	3

UNIT-I   **SYNCHRONOUS RELUCTANCE MOTORS**   **9**

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications.

UNIT II   **STEPPER MOTORS**   **9**

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

UNIT III   **SWITCHED RELUCTANCE MOTORS**   **9**

Constructional features –- Principle of operation – Torque production – Steady state performance prediction- Power Converters and their controllers –Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control– Applications

UNIT IV   **PERMANENT MAGNET BRUSHLESS D.C. MOTORS**   **9**

Permanent Magnet materials-Principle of operation – PMSM – PMBLDC - Types – Magnetic Circuit Analysis - EMF and torque equations – Power Converter Circuits and their controllers – Motor characteristics and control– Applications

UNIT V   **LINEAR MOTORS**   **9**

Linear Induction motor (LIM) classification – construction – Principle of operation – Concept of current sheet – goodness factor – DC Linear motor (DCLM) types – circuit equation - DCLM control applications – Linear Synchronous motor(LSM) – Types - Performance equations – Applications.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2.   T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES
1   R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', Taylor & Francis, Indian Reprint 2015.
2   P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3   T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4   K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
5   Naser A and BoldeaL,"Linear Electric Motors: Theory Design and Practical Applications", Prentice Hall Inc., New Jerscy 1987.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Comprehend the construction, principle of operation and performance of synchronous reluctance motors.
CO2   Recognize construction, principle of operation, control and performance of stepping motors
CO3   Comprehend the construction, principle of operation and performance of Switched Reluctance Motors.
CO4   Understand the construction, principle of operation, control and performance of Linear Motor
CO5   Understand the Construction, operation and Power controllers of PMBLDC Motors.

16BM422	WEARABLE SYSTEMS	L	T	P	C
		3	0	0	3

UNIT I   SENSORS   9

Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS – Based Biosensors, E-Textiles, Bio compatibility

UNIT II   SIGNAL PROCESSING   9

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Data mining

UNIT III   ENERGY HARVESTING FOR WEARABLE DEVICES   9

Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT IV   WIRELESS HEALTH SYSTEMS   9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT V   APPLICATIONS OF WEARABLE SYSTEMS   9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Annalisa Bonfiglio, Danilo De Rossi,"Wearable Monitoring Systems", Springer, 2011.
2   Sandeep K.S. Gupta, TridibMukherjee, Krishna Kumar Venkatasubramanian, "Body Area Networks Safety, Security, and Sustainability," Cambridge University Press, 2013.

REFERENCES
1   Hang, Yuan-Ting, "wearable medical sensors and systems",Springer-2013
2   Mehmet R. Yuce, JamilY.Khan, "Wireless Body Area Networks Technology, Implementation and Applications", Pan Stanford Publishing Pvt. Ltd, Singapore, 2012.
3   Guang-Zhong Yang(Ed.), "Body Sensor Networks, "Springer, 2006
4   Andreas Lymberis, Danilo de Rossi ,'Wearable eHealth systems for Personalised Health   Management - State of the art and future challenges ' IOS press, The Netherlands, 2004

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Explain need of wireless health systems
CO2   understand application of wearable systems
CO3   explain the fabrics of wearable device
CO4   analyse the energy harvesting techniques
CO5   acquire signals from wireless devices

16BM423	**PHYSIOLOGICAL MODELING**	L	T	P	C
		3	0	0	3

UNIT I   SYSTEM CONCEPT   9

Review of physiological system modelling- system properties- different configurations of tracheal network, static and dynamic resistance, Thermal resistance in human systems, System with volume storage capacity and its electrical analog, Simplified model of respiratory system, Simulation of aortic segments, Comparison of muscle model isotonic response, Step response of resistant / compliant systems –Dye dilution study of circulation, pulse response of first order system.

UNIT II   TRANSFER FUNCTION   8

System as an operator and use of Transfer function, Bio Engineering of coupled systems, Examples of transformed signals and circuits for transfer function with impedance concept- Development of lung model, Impedance of a two stage ladder network, Measurement of airway resistance.

UNIT III   PERIODIC SIGNALS   10

Sinusoidal Functions, Analysis of Instrumentation to measure air flow system, second order system – representation of a respiratory system, Evaluation of Transfer function from frequency response for muscle response modes, Relationship between Phase lag and Time Delay-closed loop aspects of pupillary control system , Transient Response of an Undamped Second order system, General Description of Natural Frequency Damping, Physical Significance of under damped responses of post systolic operations in aortic arch

UNIT IV   FEEDBACK   10

Characterization of Physiological Feedback systems- Hypophysis adrenal systems, pupillary hippus, Uses and Testing of System Stability, Simulation-Hodgkin-Huxley model, Model of cardiovascular variability.

UNIT V   SIMULATION OF BIOLOGICAL SYSTEMS   8

Simulation of thermal regulation, pressure and flow control in circulation, occulo motor system, Endocrinal system, functioning of receptors, introduction to digital control system.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Willian B. Blesser, "A System Approach to Biomedicine", McGraw Hill Book Co., New York, 1969
2   Manfreo Clynes & John H.Milsum, "Biomedical Engineering System", McGraw Hill & Co., New York, 1970
3   MichealC.K.Khoo, "Physiological Control System Analysis, Simulation and Estimation" Prentice Hall of India, New Delhi, 2001

REFERENCES
1   Richard Skalak and Shu Chien, "Hand Book of Biomedical Engineering", Mc Graw Hill and Co. New York, 1987.
2   Douglas S. Rigg, "Control Theory and Physiological Feedback Mechanism", The Wilkliam and Wilkins Co. Baltimore, 1970.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Explain application of Physiological models
CO2   Model dynamically varying physiological system
CO3   Discuss methods and techniques to analyze and synthesis dynamic models
CO4   Develop differential equations to describe the dynamic models, simulate and visualize
CO5   Implement physiological models using software to get dynamic responses

16BM424	TELEHEALTH TECHNOLOGY	L	T	P	C
		3	0	0	3

UNIT I   TELEMEDICINE AND HEALTH   9

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth, Telecare, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

UNIT II   TELEMEDICAL TECHNOLOGY   9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN,POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Modulation techniques, Types of Antenna, Integration and operational issues, Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www). Video and audio conferencing. Clinical data – local and centralized.

UNIT III   TELEMEDICAL STANDARDS   9

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series (Video phone based ISBN) T. 120, H.324 (Video phone based PSTN), Video Conferencing, Real-time Telemedicine integrating doctors / Hospitals, Clinical laboratory data, Radiological data, and other clinically significant biomedical data, Administration of centralized medical data, security and confidentially of medical records and access control, Cyber laws related to telemedicine.

UNIT IV   MOBILE TELEMEDICINE   9

Tele radiology: Definition, Basic parts of teleradiology system: Image Acquisition system Display system, Tele pathology, multimedia databases, color images of sufficient resolution, Dynamic range, spatial resolution, compression methods, Interactive control of color, Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system - Doctors, paramedics, facilities available. Pharmaceutical information system.

UNIT V   TELEMEDICAL APPLICATIONS   9

Telemedicine access to health care services – health education and selfcare. Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability., Telemedicine access to health care services – health education and selfcare, Business aspects - Project planning and costing, Usage of telemedicine.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley, 2002.

REFERENCES
1. Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine. Royal Society of Medicine" Press Ltd, Taylor & Francis 2006
2. O'Carroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), "Public Health Informatics and Information Systems", Springer, 2003
3. Ferrer-Roca, O., Sosa - Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002
4. Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Apply multimedia technologies in telemedicine.

CO2   Explain Protocols behind encryption techniques for secure transmission of data

CO3   Apply telehealth in healthcare.

CO4   Explain the application of mobiles in health care

CO5   Analyse the business aspect of telemedicine

16MC401   **ROBOTICS AND MACHINE VISION SYSTEM**   **L   T   P   C**
                                                                     3   0   0   3

UNIT I   BASICS OF ROBOTICS   9

Introduction - Basic components of robot wrist configurations, motion - roll - Pitch - Yaw, sensors - Laws of robotics - classification of robot - work space – accuracy -resolution – repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives

UNIT II   ROBOT END EFFECTORS   9

Robot End effectors: Introduction – types of End effectors – Mechanical gripper – types of gripper mechanism - gripper force analysis - other types of gripper- special purpose grippers.

UNIT III   ROBOT MECHANICS   9

Robot kinematics: Introduction- Matrix representation - rigid motion   &   homogeneous transformation - forward & inverse kinematics - trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton-Euler formulation.

UNIT IV   MACHINE VISION & ITS APPLICATION   9

Machine vision: Basic Components - image acquisition, digital images - sampling and quantization - levels of computation - Feature extraction - windowing technique – segmentation – Thresholding - edge detection - binary morphology - grey morphology – Application : Vision and Tracking - Introduction to NI-IMAQ and IMAQ Vision

UNIT V   ROBOT PROGRAMMING & ROBOT ASSEMBLING   9

Robot programming: Robot Languages - Classification of robot language - Computer control and robot software - Basic introduction to VAL Programming & Robotic operating System (ROS) - Programming of robots using Robot C and Labview programming – Assembly of robots using Lego, Vex and Tetrix Kits - Five minute bot, Line follower, Obstacle avoidance robot, Wall following robot and other simple applications.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1 M.P.Groover, M.Weiss, R.N.Nagal, N.G.Odrey, "Industrial Robotics - Technology, Programming and Applications" Tata McGraw-Hill Education   Pvt Limited, 2008

2 K.S.Fu, R.C.Gonzalez, CSG. Lee, ―Robotics control, sensing, vision and Intelligence, McGraw Hill Education Pvt. Ltd., 2013.

REFERENCES

1 John J Craig, ―Introduction to Robotics, Pearson, 2009.

2 Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer, Indian Reprint, 2010

3 Carsten Steger, Markus Ulrich, Christian Wiedemann, - Machine Vision Algorithms and Application, WILEY-VCH, Weinheim, 2008.

4 Aaron Martinez and Enrique Fernandez, ―Learning ROS for Robotics Programming, PACKT Publishing, 2013.

5 Bruno Siciliano, Oussama Khatib, Springer Hand book of Robotics, Springer, 2008.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Know the fundamentals of Robot.
CO2 Recognize various robot components, parts and the End-effectors
CO3 Comprehend Robot transformation system and its application to a robots Kinematic and Dynamic structure
CO4 Understand Image Processing and its application in Machine Vision System
CO5 Understand the basics of robot programming and Robot Assembling

16GE303	TOTAL QUALITY MANAGEMENT	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	3

UNIT I INTRODUCTION 9

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

UNITII TQM PRINCIPLES 9

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

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

Statistical fundamentals – Measures of central Tendency and Dispersion - Population and Sample, Control Charts for variables and attributes, Industrial Examples. Process capability. Concept of six sigma – New seven Management tools.

UNIT IV TQM TOOLS 9

Bench marking -Reason to bench mark, Bench marking process - FMEA - Stages, Types. Quality Function Deployment (QFD) - House of Quality - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems - ISO 9001-2015 Quality System - Elements, Implementation of Quality System Documentation, Quality Auditing - QS 9000 – BS-OHSAS 18001: 2007, ISO 20000, ISO 22000 IATF 16949: 2016, ISO 14001:2015, AS9100– Concept, Requirements and Benefits- Case studies.

L:45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Dale H. Besterfiled, "Total Quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2016.
2. SubburajRamasamy" Total Quality Management" Tata Mcg raw hill edition, 2015.

REFERENCES
1. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2010.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012. .
3. Dr S. Kumar, "Total Quality Management", Laxmi Publications Ltd., New Delhi 2006.
4. P. N. Muherjee, "Total Quality Management", Prentice Hall of India, New Delhi, 2015.
5. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2010.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 State about the recent techniques followed in quality approach.
CO2 Improve Leadership Skills.
CO3 Implement the Concepts of SPC Tools in Industrial Activity.
CO4 Examine the TQM Tools in Several Engineering fields.
CO5 Explain about the ISO and QS certification process and its need for the industries.

16GE304	**PRINCIPLES OF MANAGEMENT**	**L**	**T**	**P**	**C**
	(Common to all B.E. / B. Tech. Courses)	**3**	**0**	**0**	**3**

UNIT I INTRODUCTION TO MANAGEMENT 9

Management: Definition - Evolution of Management Studies –Nature, Functions, Levels and role of management - Basic Principles and Process of Management - Management vs. Administration – Taylor & Fayol's contribution to Management - Role of Managers.

UNIT II PLANNING 9

Planning: Basic types of planning – Characteristics of a good plan- Features - Planning process- Obstacles in planning - MBO, Policy - Policy formulation - Types of policies - Forecasting, Process, Importance – Decision making process.

UNIT III ORGANISING 9

Organization: Need - forms of organization - features of a good organization. Departmentation –- manuals - span of management, factors affecting span of management – delegation of authority and responsibility - centralization and decentralization.

UNIT IV STAFFING & DIRECTING 9

Staffing: Meaning, Nature, Need, and Process. Directing - Characteristics, Importance and Techniques of directing. Event & Time Management - Scope, Importance - Coordination - Need for coordination.

UNIT V CONTROLING 9

Concept of Control – Importance of control- Essentials of control system - Process of control – Communication - Process of Communication - Types - Barriers - Management Information Systems.

L:45 T:0 P: 0 Total: 45 PERIODS

TEXT BOOKS
1 Harold Koontz, and Weihrich, 'Essential of Management' 8th Edition, Tata Mc Graw Hill Education, Delhi, (2010) .
2. Tripathy.P.C and Reddy.P.N., 'Higher Principles of Management' Tata Mc-Graw Hill Publishing Company limited, New Delhi (2011).

REFERENCES
1 Stephen.P.Robbins, Mary coulter, NeharikaVohra 'Management', 10th Edition, Tata Mc-Graw Hill Publishing Company limited, New Delhi (2010).
2 Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2011).
3 VSP Rao, V.Hari Krishna, 'Management, Excel Books (2010).
4 Dr.Kumkum Mukherjee, 'Principles of Management, 2nd Edition, Tata Mc Graw Hill, (2009).

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Discuss and communicate the management evolution and how it will affect future managers.
CO2 Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment.
CO3 Practice the process of management's four functions: planning, organizing, leading, and controlling.
CO4 Use appropriate methods of communication in the Business Environment.
CO5 Gather and analyze both qualitative and quantitative information to isolate issues and formulate best control methods.

16GE305	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	3

UNIT I   INTRODUCTION   9

Meaning, Relevance, Business Impact, Protection of Intellectual Property - Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications.

UNIT II   PATENTS   9

Concept of Patent - Product / Process Patents & Terminology - Duration of Patents- Law and Policy Consideration Elements of Patentability - Procedure for Filing of Patent Application and types of Applications - Ownership and Maintenance of Patents - Assignment and licensing of Patents.

UNIT III   TRADEMARK   9

The rationale of protection of trademark as (a) an aspect of commercial and (b) of consumer rights - Definition and concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Procedure for Registration of Trademarks.

UNIT IV   COPYRIGHT   9

Nature of Copyright - Author & Ownership of Copyright - Rights Conferred by Copyright - Assignment, Transmission, Licensing of Copyrights - Copyright pertaining to Software/Internet and other Digital media.

UNIT V   INDUSTRIAL DESIGNS   9

What is a Registrable Design - Novelty & Originality - Procedure for Registration of Designs - Copyright under Design - Assignment, Transmission, Licenses - Procedure for Cancellation of Design.

L:45   T:0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Aswani Kumar Bansal, 'Law of Trademarks in India', Commercial Law Publisher, 3rd edition, 2014.
2. B L Wadehra, 'Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications', Universal Law Publishing Co, Fifth Edition, 2014.

REFERENCES
1. Krishnamurthy G.V.G, 'The Law of Trademarks, Copyright, Patents and Design'. Macmillan Publishers Limited, 2012.
2. Satyawrat Ponkse, 'The Management of Intellectual Property', Bhate & Ponkshe Publishers, 1991.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.

CO2 Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development

CO3 Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development

CO4 Familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.

CO5 Apply the different procedures in IP of various IPs

16GE306	**HRM AND ENTREPRENEURSHIP**	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	3

UNIT I   **INTRODUCTION TO HRM AND FRAMEWORK**   **9**

Nature of HRM, Scope of HRM, Functions and objectives, HRM: policies and Practices, Role of HRM in changing business environment.

UNIT II   **JOB ANALYSIS AND DESIGN & HUMAN RESOURCE**   **9**
                      PLANNING

Job Analysis: Introduction, Importance of Job analysis, The need for man power planning, Objectives, importance, benefits, process of HRP.

UNIT III   **RECRUITMENT, SELECTION AND TRAINING**   **9**

Recruitment - Selection – Induction - Types of training methods - Purpose – benefits – resistance - Types of training methods - Purpose – Benefits - Resistance.

UNIT IV   **ENTREPRENEURSHIP ENVIRONMENT**   **9**

Evaluation of the concept of Entrepreneur - Role of entrepreneurship - Knowledge and skills of entrepreneur - Need for EDP

UNIT V   **ENTREPRENEURSHIP DEVELOPMENT PROGRAMME**   **9**

Criteria for selection of a product - Matching Entrepreneur with the project - Report preparation and evaluation criteria.

L : 45   T:0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. K. Aswathappa, 'Human Resource Management: Text and Cases', 7th Edition, (2013).
2. S.S. Kanka, Entrepreneurial Development, S.Chand & Company, First Edition, 1999.
3. Mamoria C.B. and Mamoria S. 'Personnel Management', 1st Edition, Himalaya Publishers.

REFERENCES
1. V S P Rao, 'Human Resource Management', 3rd Edition, Excel Books, New Delhi, (2010).
2. Dessler, 'Human Resource Management', 12th Edition, Pearson India, (2011).
3. David A. Decenzo, 'Human Resource Management', WILEY India PVT. Ltd, New Delhi.
4. David H.Holt, Asoke K. Ghosh, Porentice New Venture Creation, Sixth Edition, 2002.
5. R.K.Singal, Entrepreneurship Development and Management, Published by S.K KATARIA ,Darya Ganj, New Delhi, 2009.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Develop the knowledge, skills and concepts needed to resolve actual human resource management problems or issues.
CO2   Manage the employment relationship, which is a shared responsibility between employers, management, human resources specialists, and employees.
CO3   Investigate how HRM is responding to current business trends, opportunities, and challenges.
CO4   Develop the knowledge, skills and concepts of Entrepreneurship.
CO5   Evaluate the procedures and practices used for setting up an enterprise.

16BM460	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

UNIT I   FUNDAMENTALS OF PRODUCT DEVELOPMENT   9

Global trends analysis and product decision- Social trends- Technical trends- Economical trends- Environment trends- Political/ Policy trends- Introduction to product development methodologies and management- Overview of product and services- Types of product development- Overview of product development methodologies- Product life cycle- Product development planning and Management

UNIT II   REQUIREMENTS AND SYSTEM DESIGN   9

Requirement Engineering- Types of requirements- Requirement engineering- Traceability Matrix and analysis- Requirement management- System Design and Modelling- Introduction to system modelling- System Optimization- System specification- Sub system design- Interface design.

UNIT III   DESIGN AND TESTING   9

Conceptualization- Industrial design and user Interface design- Introduction to concept generation techniques- Challenges in integration of engineering disciplines- Concept screening and evaluation- Detailed design- Component design and verification- Mechanical, Electronics and software subsystems- High level design/ Low level design of S/W program- Types of prototypes, S/W testing- Hardware schematics, Component design, Layout and hardware testing- Prototyping- Introduction to rapid prototyping and rapid manufacturing- System integration, Testing, Certification and documentation

UNIT IV   SUSTENANCE ENGINEERING AND END OF LIFE(EOL) SUPPORT   9

Introduction to product verification processes and stages- Introduction to product validation processes and stages- Product testing standards and certification- Product documentation- Sustenance- Maintenance and repair- Enhancements- Product EOL- Obsolescence management- Configuration management- EOL disposal

UNIT V   BUSINESS DYNAMICS ENGINEERING SERVICES INDUSTRY   9

The industry- Engineering services industry- Product development in industry versus Academia- The IPD Essentials- Introduction to vertical specific product development processes- Manufacturing/ Purchase and assembly of systems- Integration of mechanical, Embedded and S/W systems- Product development trade-offs- Intellectual property rights and confidentiality- Security and configuration management.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1. Karl T Ulrich and Stephen D Eppinger, "Product design and development" Tata McGraw Hill, fifth edition, New Delhi, 2011
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, New Delhi, 2005

REFERENCES

1. Hiriyappa B, "Corporate Strategy"- Managing the business, Authorhouse, USA, 2013
2. Peter F Drucker, "People and performance", Butterworth – Heinemann [Elseveir], Oxford, UK, 2004.
3. Vinod Kumar garg and Venkitakrishnan N K, "Enterprise resource planning"- Concepstand practice", Prentice Hall India, New Delhi, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in engineering and Design", McGraw Hill Education, Seventh Edition, New Delhi, 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Define, formulate and analyze a problem

CO2   Solve specific problems independently or as part of a team

CO3   Develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

CO4   Work independently as well as in teams

CO5   Manage a project from start to finish

16BM461   **FIBER OPTICS AND LASERS IN MEDICINE**   L   T   P   C
                                                                                   3   0   0   3

UNIT I   OPTICAL PROPERTIES OF THE TISSUES   9
Refraction, scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, opto thermal interaction, fluorescence, speckles

UNIT II   INSTRUMENTATION IN PHOTONICS   9
Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, optical filters, polarisers, time resolved and phase resolved detectors.

UNIT III   APPLICATIONS OF LASERS   9
Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

UNIT IV   OPTICAL HOLOGRAPHY   9
Wave fronts, interference patterns, principle of hologram, optical hologram, applications.

UNIT V   SPECIAL TECHNIQUES   9
Near field imaging of biological structures, in-vitro clinical diagnostic, fluorescent spectroscopy, photodynamic therapy.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Leon Goldman, M.D., & R.James Rockwell, Jr., "Lasers in Medicine", Gordon and Breach, Science Publishers Inc., 1975
2   Abraham Katzir, "Lasers and Optical Fibers in Medicine", Academic Press Edition, 1998.

REFERENCES
1   Tuan Vo Dirh, "Biomedical Photonics – Handbook", CRC Press, Bocaraton,2003
2   Glasser, O., "Medical Physics -- Vol 1, 2, 3 "Adam HilgarBrustol Inc, 1987.
3   G.David Baxter "Therapeutic Lasers – Theory and practice", Churchill Livingstone Publications Edition-2001.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Apply lasers in different areas of medicine
CO2   Explain the special techniques of Lasers
CO3   Use the Photonics instrumentation
CO4   Application of LASER
CO5   Explain medical device using LASER

16BM462	BIO MEMS	L	T	P	C
		3	0	0	3

UNIT I   MEMS MATERIALS AND FABRICATION   9

Typical MEMs and Microsystems, materials for MEMS - active substrate materials-Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachining-photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA

UNIT II   MECHANICAL AND THERMAL SENSORS AND ACTUATORS   9

Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermo mechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – micro plates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys - Inertia sensor, flow sensor

UNIT III   ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND   9
**   ACTUATORS**

Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT IV   MICROFLUIDIC SYSTEMS   9

Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in micro conduits, in sub micrometer and nanoscale. Micro scale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, micro fluid dispenser, micro needle, micro pumps-continuous flow system, micro mixers

UNIT V   APPLICATIONS OF BIOMEMS   9

CAD for MEMs, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, micro system approaches to polymerase chain reaction (PCR), DNA sensor, MEMS based drug delivery

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1 Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2002.
2 Wanjun Wang, Stephen A.Soper, "BioMEMs: Technologies and Applications", CRC Press, New York, 2007.

REFERENCES
1 Marc J. Madou "Fundamentals of Microfabrication: the Science of Miniaturization", CRC Press, 2002
2 Nadim Maluf, Kirt Williams. "An introduction to Microelectro Mechanical Systems Engineering", Second Edition, Artech House Inc, MA, 2004.
3 Chang Liu," Foundations of MEMS", Pearson Education International, New Jersey, USA,2006
4 Nitaigour Premchand Mahalik, "MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Discuss various MEMS fabrication techniques
CO2 Explain different types of sensors and actuators
CO3 Apply MEMS in different field of medicine
CO4 Explain principles of operation at the micro Scale level
CO5 Explain micro fluid systems

16BM463   ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEM   L   T   P   C

3   0   0   3

UNIT I   INTRODUCTION & SEARCH STRATEGIES   9

Intelligence: history, the state of the art - Intelligent agents: structure, environment. Breadth-first search, uniform cost search, depth-first search, depth-limited search, iterative deepening search, bidirectional search, heuristic search techniques, comparing search strategies.

UNIT II   KNOWLEDGE AND REASONING   9

Representation, logic: propositional logic, using predicate logic, using rules, forward and backward chaining, strong and weak slot fillers.

UNIT III   PLANNING   9

Overview, components, goal stack planning, non-linear planning, hierarchical planning, reactive systems.

UNIT IV   UNCERTAINTY   9

Non-monotonic reasoning, logics, implementation, probability and Bayes theorem, certainty factors - Bayesian networks, dempster - Shafer theory

UNIT V   EXPERT SYSTEMS   9

Stages in development - structure: knowledge base structure - Languages - LISP & PROLOG

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1   Stuart Russell, Peter Norvig, "Artificial Intelligence - A Modern Approach", Pearson Education, New Delhi, 2003

2   Elaine Rich , Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, New Delhi, 2009.

REFERENCES

1   Dan W Patterson, "Introduction to AI and Expert Systems", Prentice Hall of India, New Delhi, 2005.

2   Eugene Charniak, Drew McDermott, "Introduction to Artificial Intelligence", Pearson Education, New Delhi, 2002

3   Nils J Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, New Delhi, 2001.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Understand different types of AI agents

CO2   Know various AI search algorithms

CO3   Understand the fundamentals of knowledge representation

CO4   Know how to build simple knowledge-based systems

CO5   write simple Lisp programs

16BM464	NEURAL ENGINEERING	L	T	P	C
		3	0	0	3

UNIT I   BASICS OF NEURON STRUCTURE AND FUNCTIONS   9

Nervous system development. Trophic factors, extra cellular matrix components in nervous system development. Neuron: structure – function – classification. Glial cells – myelination - Neurotransmitter – types and functions. Synapses - Transport of materials and impulse in neurons; Blood Brain barrier.

UNIT II   BRAIN, BRAIN STEM AND SPINAL CORD   9

Brain: structures – lobes – functional areas. Brain stem: structures – functional areas. Spinal cord: structure – functions. Concepts of nuclei – Tracts - Reticular formation. Blood supply of Brain and spinal cord.

UNIT III   NEUROPHYSIOLOGY & NEURORADIOLOGY   9

Physiology of nerve conduction. Peripheral nerves – structure & Functions. Synaptic transmission and cellular signaling of Neurons. Electrical activity of the Brain and recording of brain waves. Evoked potentials. Visualization of nervous system.

UNIT IV   NEURONAL DISEASES AND DISORDERS   9

Neuro degeneration: Degenerative, Demyelinated and injury related disorders associated with nervous system. Wallerian Degeneration. Neuronal plasticity –CNS acting drugs and their pharmacokinetics.

UNIT V   NERVE RECONSTRUCTION AND REPAIRING   9

Regeneration of the nervous system. Nerve graft; Neural tissue engineering; Drug delivery system in CNS. Cognitive & neurobehavioral rehabilitation.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Mathews G.G. "Neurobiology", 2nd edition, Blackwell Science, UK, 2000.
2   Malcom Carpenter, "Neuroanatomy", Mc Graw Hill 4th Edition.1991.

REFERENCES
1   W. Mark Saltzman Tissue Engineering – Engineering principles for design of replacement organs and tissue –- Oxford University Press Inc New York 2004
2   Park J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.
3   NitaigourPremch and Mahalik, "MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Explain the structure of human nervous system
CO2   Apply neural tissue engineering for rehabilitation
CO3   Regenerate nervous system
CO4   Explain neural disease
CO5   Understand nerve grafting

16BM465	BIOMETRICS	L	T	P	C
		3	0	0	3

UNIT I   INTRODUCTION TO BIOMETRICS   9

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrollment – templates – algorithm – verification – Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication - Protecting privacy and biometrics and policy – Biometric applications – biometric characteristics

UNIT II   FINGERPRINT TECHNOLOGY   9

History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques – fingerprint quality assessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching

UNIT III   FACE RECOGNITION AND HAND GEOMETRY   9

Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction - Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithm – Biometric fusion.

UNIT IV   MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION   9

Voice Scan – physiological biometrics –Behavioral Biometrics - Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy –training and adaptability – examples of multimodal biometric systems – Performance evaluation- Statistical Measures of Biometrics – FAR – FRR – FTE – EER – Memory requirement and allocation.

UNIT V   BIOMETRIC AUTHENTICATION   9

Introduction - Biometric Authentication Methods - Biometric Authentication Systems – Biometric authentication by fingerprint -Biometric Authentication by Face Recognition. -. Expectation- Maximization theory - Support Vector Machines. Biometric authentication by fingerprint –biometric authentication by hand geometry- Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC) – Multibiometrics and Two-Factor Authentication

        L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, "Biometric Systems, Technology Design and Performance Evaluation", Springer, 2005
2. S.Y. Kung, S.H. Lin, M.W.Mak, "Biometric Authentication: A Machine Learning Approach" Prentice Hall, 2005

REFERENCES

1. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, "Automatic fingerprint Recognition System", Springer, 2003
3. L C Jain, I Hayashi, S B Lee, U Halici, "Intelligent Biometric Techniques in Fingerprint and Face Recognition" CRC Press, 1999.
4. John Chirillo, Scott Blaul, "Implementing Biometric Security", John Wiley, 2003.
5. Arun A. Ross, Karthik Nanda Kumar, Anil K. Jain, "Handbook of Multibiometrics", Springer, 2006

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Demonstrate knowledge engineering principles underlying biometric systems.
CO2 Analyze design basic biometric system applications.
CO3 Evaluate the biometric system
CO4 Analyze the biometric authentication system
CO5 Understand face recognition

16BM466	BIOFLUIDS AND DYNAMICS	L	T	P	C
		3	0	0	3

UNIT I BIO-FLUID MECHANICS 10

Newton's laws, Stress, Strain, Elasticity, Hooks-law, viscosity, Newtonian fluid, Non-Newtonian fluid, Viscoelastic fluids, vascular tree, Relationship between diameter, velocity and pressure of blood flow, Resistance against flow. Bioviscoelastic fluid: Viscoelasticity - Viscoelastic models, Maxwell, Voigt and Kelvin Models, Response to Harmonic variation, Use of viscoelastic models, Bio- Viscoelastic fluids: Protoplasm, Mucus, Saliva, Synovial fluids.

UNIT II FLOW PROPERTIES OF BLOOD 10

Physical, Chemical and Rheological properties of blood. Apparent and relative viscosity, Blood viscosity variation: Effect of shear rate, hematocrit, temperature, protein contents of blood. Casson's equation, Problems associated with extracorporeal blood flow. Rheology of Blood in Micro vessels: Fahraeus - Lindquist effect and inverse effect, distribution of suspended particles in a narrow rigid tube. Nature of red blood cells in tightly fitting tubes, hematocrit in very narrow tube.

UNIT III CARDIAC MECHANICS 9

Cardiovascular system. Mechanical properties of blood vessels: arteries, arterioles, capillaries and veins. Blood flow: Laminar and Turbulent, Physics of cardiovascular diseases, Prosthetic heart valves and replacements. Respiratory Mechanics: Alveoli mechanics, Interaction of Blood and Lung P-V curve of Lung: Breathing mechanism, Airway resistance, Physics of Lung diseases.

UNIT IV SOFT TISSUE MECHANICS 8

Pseudo elasticity, non-linear stress-strain relationship, Viscoelasticity, Structure, function and mechanical properties of skin, ligaments and tendons.

UNIT V ORTHOPEDIC MECHANICS 8

Mechanical properties of cartilage, diffusion properties of Articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, lubrication of joints.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS
1 Y.C Fung, "Biomechanics- Mechanical properties of living tissues", 2nd Edition, Springer-Verlag, 1993.

REFERENCES
1 David A. Rubenstein, Weiyin, Mary D. Frame, "Biofluid Mechanics- An Introduction to fluid Mechanics, Macro circulation and Microcirculation", Springer, 2013.
2 Silver Frederick H. Biomaterials, Medical Devices & Tissue Engineering: Chapman & Hall, London, 1994
3 Nihanthozkai, D.A Mc Donald,"Biomechanics, Blood flow in arteries", Edward Arnold ltd, 1998.
4 D.O Cooney, Biomedical Engineering Principles. Marcel Dekker, INC New York.1976.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Discuss on Cardiovascular and pulmonary system in human body
CO2 Explain blood properties
CO3 Explain the anatomy and physiology of blood vessels
CO4 Discuss on orthopedic mechanics
CO5 Discuss on bio fluid

16EI452   **NEURAL NETWORKS AND FUZZY LOGIC**   L   T   P   C
                                                                      3   0   0   3

UNIT I   ARCHITECTURES   9
Introduction- Biological neuron- Artificial neuron- Neuron modeling- Learning rules- Single layer feed forward network- Multi-layer feed forward network- Back propagation Algorithm-Learning factors.

UNIT II   NEURAL NETWORKS FOR CONTROL   9
Introduction- Feedback networks- Discrete time hop field networks- Applications of artificial neural network- Process identification- Case Study (Neuro controller for inverted pendulum).

UNIT III   FUZZY SYSTEMS   9
Introduction- Classical sets- Fuzzy sets- Fuzzy relations- Fuzzification- Defuzzification-Fuzzy rules.

UNIT IV   FUZZY LOGIC CONTROL   9
Membership function- Different types of MF"s- Knowledge base- Decision-making logic-optimizations of membership function using neural networks- Adaptive fuzzy systems.

UNIT V   APPLICATION OF FLC   9
Fuzzy logic control- inverted pendulum-Image processing-Home Heating system-Blood pressure during anesthesia.

                                        L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
  1   J.S.R. Jang, C.T. Sun and E. Mizutani, „Neuro - Fuzzy and Soft Computing", PHI, Pearson Education 2004
  2   S.N.Sivanandam, S.N. Deepa, „Principles of Soft Computing", 2nd Edition, Wiley India, 2011

REFERENCES
  1   S. Rajasekaran, GA VijayalakshmiPai, „Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India Private Limited, 2003
  2   Laurene Fausett, „Fundamentals of Neural Networks, Architectures, Algorithms and Applications", Prentice Hall, Englewood cliffs, 2000
  3   Zimmerman H.J., „Fuzzy set theory and its Applications", Kluwer Academic Publishers Dordrecht, 2001.
  4   Klir, G.J. Yuan Bo, „Fuzzy sets and Fuzzy Logic: Theory and Applications", Prentice Hall of India Pvt. Ltd., 2005.

COURSE OUTCOMES
At the end of the course student should be able to:
  CO1   Expose to the concepts of feed forward neural networks
  CO2   Adequate knowledge on control schemes used in neural networks
  CO3   Understanding the various types of classical sets, Fuzzy sets and its properties.
  CO4   Understand about the membership function and its calculation for various systems
  CO5   Analyze the various types and applications of Fuzzy Logics and Artificial Neural Networks

16BM467	MEDICAL INFORMATICS	L	T	P	C
		3	0	0	3

UNIT I   MEDICAL INFORMATICS   9

Introduction – Medical Informatics – Bioinformatics – Health Informatics - Structure of Medical Informatics –Functional capabilities of Hospital Information System - On-line services and Off – line services - Dialogue with the computer

UNIT II   MEDICAL STANDARDS   9

Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA – Electronics Patient Records – Healthcare Standard Organizations – JCAHO (Joint Commission on Accreditation of Healthcare Organization) - JCIA (Joint Commission International Accreditation) - Evidence Based Medicine - Bioethics.

UNIT III   MEDICAL DATA STORAGE AND AUTOMATION   9

Representation of Data, Data modeling Techniques, Relational Hierarchical and network Approach, Normalization techniques for Data handling - Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface – Medical Data formats – Signal, Image and Video Formats – Medical Databases - Automation in clinical laboratories - Intelligent Laboratory Information System – PACS.

UNIT IV   HEALTH INFORMATICS   9

Bioinformatics Databases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics, Education and Training

UNIT V   RECENT TRENDS IN MEDICAL INFORMATICS   9

Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment – Surgical simulation - Radiation therapy and planning – Telemedicine – virtual Hospitals - Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. R.D.Lele, "Computers in medicine progress in medical informatics", Tata McGraw Hill Publishing Ltd, 2005
2. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Ltd, 2003

REFERENCES
1. OrpitaBosu and Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", Oxford University press, 2007.
2. Yi Ping Phoebe Chen, "Bioinformatics Technologies", Springer International Edition, New Delhi, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Discuss about health informatics
CO2 Explain the function of Hospital Information Systems
CO3 Analyze medical standards
CO4 Discuss about the different ICT applications in medicine
CO5 Discuss on the education and training of health informatics

16BM468	**ASSIST DEVICES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

UNIT I   CARDIAC ASSIST DEVICES   9

Principle of External counter pulsation techniques, intraaortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II   HEMODIALYSERS   9

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

UNIT III   HEARING AIDS   9

Common tests – audiograms, Air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV   PROSTHETIC AND ORTHODIC DEVICES   9

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, sensory assist devices.

UNIT V   RECENT TRENDS   9

Transcutaneous electrical nerve stimulator, bio-feedback.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Levine S.N. (ed), "Advances in Bio-medical Engineering and Medical physics", Vol. I, II, IV, inter university publications, New York, 1968
2. Kolff W.J, "Artificial Organs", John Wiley and sons, New York, 1976.
3. Albert M.Cook and Webster J.G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey, 1982

REFERENCES
1. D.S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publication, 2010.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Explain the functioning and usage of electromechanical units which will restore normal functional ability of particular organ that is defective temporarily or permanently.
CO2 Discuss on the function of hearing aid
CO3 Explain the orthopedic devices for different health cases
CO4 Discuss the recent trends in the assisting g devices
CO5 Explain the rehabilitation

16BM469	**REHABILITATION ENGINEERING**	L	T	P	C
		3	0	0	3

**UNIT I   INTRODUCTION TO REHABILITATION & REHABILITATION   9
                TEAM**

What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities, Rehabilitation team-Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer.

UNIT II   PRINCIPLES OF REHABILITATION   9

Introduction, The Human Component, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles - Practice of Rehabilitation and Assistive Technology.

UNIT III   THERAPEUTIC EXERCISE TECHNIQUE   9

Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT IV   PRINCIPLES IN MANAGEMENT OF COMMUNICATION   9

Impairment-introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient, Augmentative communication-general form of communication, types of visual aids, Hearing aids, Types of conventional hearing aid, Writing aids.

UNIT V   ORTHOTIC & PROSTHETIC DEVICES   9

General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Calipers- FO, AFO, KAFO, HKAFO. Prosthetic devices: Hand and arm replacement, Body powered prosthetics; Myoelectric controlled prosthetics and Externally powered limb prosthetics.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Dr. S. Sunder, Rehabilitation Medicine-, 3rd Edition, Jaypee Medical Publications, New Delhi. 2010
2   Joseph D.Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006

REFERENCES
1   Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor & Francis, CRC press, 2006.
2   Susan B O Sullivan, Thomas J Schmitz, Physical Rehabilitation. 5th Edition, Davis publications, 2007.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Explain the needs of rehabilitations
CO2   Describe therapeutic exercise techniques, Orthopedic Prosthetics, Orthotics
CO3   Describe the types of aids in health care for rehabilitation
CO4   Discuss the future development of rehabilitation
CO5   Practice Rehabilitation and Assistive Technology

16BM470	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

UNIT I   BASIC CONCEPTS   9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT II   SPEECH ANALYSIS   9

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III   SPEECH MODELING   9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV   SPEECH RECOGNITION   9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V   SPEECH SYNTHESIS   9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.
3. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.

REFERENCES

1. Steven W. Smith, "The Scientist and Engineers Guide to Digital Signal Processing", California Technical Publishing, 1997.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2004.
3. Claudio Becchetti and Lucio PrinaRicotti, "Speech Recognition", John Wiley and Sons, 1999.
4. Ben Gold and Nelson Morgan, "Speech and audio signal processing, Processing and Perception of Speech and Music", Wiley- India Edition, 2006.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Model speech production system and describe the fundamentals of speech.
CO2   Extract and compare different speech parameters
CO3   Choose an appropriate statistical speech model for a given application
CO4   Design a speech recognition system.
CO5   Use different speech synthesis techniques

PROFESSIONAL ELECTIVE - VII

16BM471   **MEDICAL RADIATION SAFETY ENGINEERING**   L   T   P   C
                                                                3   0   0   3

UNIT I   **INTRODUCTION TO RF AND MICROWAVE RADIATION**   **9**

Source of radio frequency radiation- Effects of radio frequency radiation-Development of standards for human safety- Calculation of RF field quantities- RF radiation measuring instruments and methods

UNIT II   **RADIATION DETECTION AND MEASUREMENT**   **9**

Fundamentals of radiation detection- Conducting radiation measurements and surveys- Gas detectors- Designing to reduce radiation hazards- Radio frequency radiation safety management and training-scintillation detectors- Statistics of counting- minimum detectable activity- Quality assurance of radiation counters.

UNIT III   **RADIATION SAFETY IN NUCLEAR MEDICINE AND**   **9**
                RADIOTHERAPY

Design and description of NM department- Radiation protection in nuclear industry- Guidelines for radiation protection- Molecular medicine and radiation safety program- Procedure for safe operation of radiation equipment- Radiation protection in external beam radiotherapy- Radiation protection in brachytherapy- Radioactive wastes.

UNIT IV   **LASER AND ULTRAVIOLET RADIATION SAFETY**   **9**

Classification of UV radiation- Sources of UV- Biological effects of UV- Hazards associated with UV radiation- UV control measures- Safety management of UV- classification of LASER and its radiation hazards- control measures- Emergencies and incident procedures.

UNIT V   **MONITORING AND INTERNAL DOSIMETRY**   **9**

Monitoring methods – personal radiation monitoring- Records of Personal dosimetry- ICRP method-MIRD method- internal doses from radiopharmaceuticals- Bioassay of radioactivity- Hazard and risk in radiation protection- radiological incidents and emergencies- regulation to radiation protection

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Jamie V, Trapp, Thomas Kron. "An introduction to radiation protection in medicine", CRC press Taylor & Francis group, 2008.
2. Alan Martin, Samuel Harbison, Karen Beach, Peter Cole, Hodder Arnold." An introduction to radiation protection", 6th edition 2012.

REFERENCES
1. Max Hlombardi," Radiation Safety in nuclear medicine", CRC press Taylor &Francis group, 2nd edition, 2007.
2. ArunaKaushik, Anupammondal, Dwarkanath B.S, TripathiR.P, "Radiation protection manual", INMAS, DRDO 2010
3. Ronald kitchen, "RF and microwave radiation safety", Newness publishers, 2nd edition ,2001.

COURSE OUTCOMES

At the end of the course student should be able to:
CO1   Explain the basics of radiation physics.
CO2   Understand the guidelines of radiation protection and radiation detectors.
CO3   Provide information on safety measures related to UV, laser and nuclear medicine
CO4   Provide sufficient information on the various precautionary
CO5   Discuss safety measures for radiation protection in medicine.

16BM472	BIOSTATISTICS	L	T	P	C
		3	0	0	3

UNIT I INTRODUCTION 9
Scope and role in life science, Population and sample, variables, collection of data, classification and tabulation of data. Diagrams and graphs.

UNIT II PROBABILITY 9
Probability scale, measurement of probability, laws of probability of independent events, conditional probability, Bayes' theorem. Probability distributions- binomial, normal, Poisson and distributions

UNIT III SAMPLING 9
Sampling variation and bias, Nonprobability sampling techniques- convenience, purposive, quota. Probability sample techniques- simple random, stratified random, systematic, cluster, multistage sampling. Sample size. Sample distribution. Statistical interference. Type I and II errors. Test of significance and estimation

UNIT IV CORRELATION AND REGRESSIONS 9
Simple linear correlation and regression, multiple regression analysis, multiple and partial correlation coefficients.(No derivation).

UNIT V STATISTICAL METHODS 9
Chi-square test – formula, distribution, degree of freedom, applications, misuse. Analysis of variance- F test , one way ANOVA, two models of ANOVA, assumptions, extensions to two way ANOVA. Non-parametric statistical tests- advantages and disadvantages. Stochastic models in life science.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Zar JH. "Biostatistical Analysis", Pearson Education Singapore, 2003.
2. Sundar Rao PSS., Richard J. "An introduction to Biostatistics. A model for students in health sciences", Prentice Hall of India Pvt. Ltd. New Delhi 3rd Edition, 2006.

REFERENCES
1. Glantz SA., "Primer of Biostatistics" McGraw Hill New York 4th Edition, 1997

COURSE OUTCOMES
At the end of the course student should be able to:

CO1 Explain the role of analysis of data
CO2 Discuss the various measurement of probability
CO3 Analyze the data using the sampling theorem
CO4 Describe the statistical methods and models
CO5 Explain the errors in the collection of data during sampling

16BM473   **ICU AND OPERATION THEATRE EQUIPMENT**   **L   T   P   C**
                                                                      3   0   0   3

UNIT I   ICU EQUIPMENT   9

Suction apparatus: different types - Sterilizers: chemical, radiation, steam for small and large units - automated drug delivery systems: infusion pumps, closed loop control infusion system, implantable infusion system

UNIT II   CRITICAL CARE EQUIPMENT   9

Hemodialysis machine: different types of dialyzers, membranes, machine controls and measurements - heart lung machine: different types of oxygenators, peristaltic pumps - incubators.

UNIT III   OT EQUIPMENT   9

Surgical diathermy, instruments for operation - anesthesia equipment: humidification, sterilization aspects -Boyles apparatus.

UNIT IV   CENTRALIZED SYSTEMS   9

Centralized oxygen, nitrogen, air supply & suction - centralized   air-conditioning - operation theatre table & lighting

UNIT V   PATIENT SAFETY   9

Patient electrical safety - types of hazards, natural protective mechanisms against electricity, leakage current, inspection of grounding and patient isolation - hazards in operation rooms, ICCU and IMCUs - Opto couplers and pulse transformers

                              L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Khandpur R S, "Handbook of Bio-Medical Instrumentation", Tata McGraw Hill, New Delhi, 2003.
2. Joseph J Carr , John M Brown, "Introduction to Biomedical Equipment Technology", John Wiley & Sons, New York, 2008

REFERENCES
1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurement", PHI, New Delhi, 2011
2. Mandeep Singh, "Introduction to Biomedical Instrumentation", PHI, New Delhi, 2010
3. R. Anandanatarajan, "Biomedical Instrumentation and Measurements", PHI, New Delhi, 2011

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Explain the basics of ICU, CCU& OT systems
CO2   Understand the guidelines of radiation protection and radiation detectors
CO3   Provide information on centralized system of essential supply
CO4   Provide sufficient information on the various precautionary
CO5   Discuss safety measures for radiation protection in medicine

16BM474	CLINICAL ENGINEERING	L	T	P	C
		3	0	0	3

UNIT I   NEED AND SCOPE OF CLINICAL ENGINEERING   9

History of engineering and technology in health care - health care environment - clinical engineering in academic medical center - careers, roles and responsibilities - clinical engineering at the bedside

UNIT II   NATIONAL HEALTH POLICIES   9

Need for evolving health policy - health organization in the state - health financing system - health education - health insurance - health legislation - national health technology policy.

UNIT III   STANDARDS AND CODES IN HEALTH CARE   9

Necessity for standardization - standards and regulations - hospital facilities safety standards - health care quality and ISO 9001:2000 - joint commission on accreditation of hospitals organization - patient safety and clinical engineer - patient safety best practices model-hospital safety programs - radiation safety.

UNIT IV   INFORMATION SYSTEMS MANAGEMENT AND COMPUTERS   9
**   IN MEDICINE**

Physiologic monitoring and clinical information systems - advanced diagnostics and artificial intelligence - telemedicine - picture archiving and communication system - the integration and convergence of medical and information technologies - computer applications in intensive care unit - X-ray department - laboratory department - patient data - medical records.

UNIT V   ENGINEERING THE CLINICAL ENVIRONMENT   9

Physical plant - heating - ventilation - air conditioning - electrical power - medical gas system - support services - sanitation - water systems in hospitals - disaster planning.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1   Joseph Dyro, "Clinical Engineering Handbook", Elsevier Academic Press, USA, 2004.
2   Goyal R C, "Human Resource Management in Hospitals", Prentice Hall of India, New Delhi 2004.

REFERENCES
1   Yadin David, Wolf W VonMaltzahn, "Clinical Engineering", CRC Press, New York, 2003.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Explain the basics roles and responsibilities of clinical engineering
CO2   Understand the guidelines of health policy
CO3   Provide information on necessity for standardization
CO4   Provide sufficient information on the various precautionary
CO5   Discuss safety measures in medicine system

16BMOE1   **BIOMEDICAL LASER AND ITS APPLICATIONS**   L T P C
                                                                        3 0 0 3

UNIT I   OPTICAL PROPERTIES OF TISSUES   9
Scattering- Absorption- Refractive index- Light transport inside the tissue- Interaction of light with matter- Quantum behavior of light- Light interaction with tissues- Opto thermal interaction- Fluorescence- Speckles.

UNIT II   BASIC THEORY OF LASER   9
LASER action: Stimulated & Spontaneous emission- Molecular energy level- characteristics of laser- population inversion- pumping methods and levels of pumping- Optical cavity configurations- Amplification – Optical resonator and gain –Q-switching – Mode locking – LASER modes – Line broadening

UNIT III   TYPES OF LASER   9
Solid state, Ruby, Nd-YAG, Tunable solid state, Alexandrite, Titanium – Sapphire – Gas lasers: Helium – Neon, Argon, $Co2$ – Tunable dye – Semiconductor

UNIT IV   HOLOGRAPHY AND ITS MEDICAL APPLICATIONS   9
Holography – Basic principle – methods of Holography interferometry – applications – Holography for non-destructive testing – application of LASER, holography in medicine: Dentistry, ophthalmology, otology, orthopaedics

UNIT V   MEDICAL APPLICATION OF LASER   9
Photo ablation – Plasma induced ablation – Photo disruption – Applications: Ophthalmology, Density, Urology, Neurosurgery, Dermatology, Orthopaedics, Angioplasty, Cardiology, and Surgery- Diffused optical tomography.

                                        L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1 Thyagarajan K, Ajoy K, Ghatak A, "Lasers Fundamentals and Applications", Second edition, Springer 2010.
2 Markolf H. Niemz, "Laser-Tissue Interactions: Fundamentals and Application", Third edition, Springer 2007.

REFERENCES
1 Keiser, "Optical Fibre Communication Systems", McGraw Hill Ltd., Third edition, 1983
2 John E, Harry, "Industrial lasers and their applications", Second edition, McGraw Hill, 1974.
3 John F Ready, "Industrial applications of Lasers", Second edition, Academic Press, 1978.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 understand the fundamentals of different types of laser
CO2 discuss various types of laser and its mode of operation
CO3 discuss applications of lasers in medical field
CO4 understand about holography and its applications
CO5 discuss the operations and applications of LASER in medical field

16BMOE2 **ROBOTICS AND AUTOMATION IN MEDICINE** L T P C

 3 0 0 3

UNIT I INTRODUCTION OF ROBOTICS 9
Introduction to Robotics and his history, Overview of robot subsystems, Degrees of freedom, Configurations and concept of workspace, Automation, Mechanisms and movements, Dynamic stabilization- Application of robotics in medicine

UNIT II ACTUATORS AND GRIPPERS 9
Pneumatic and hydraulic actuators, stepper motor control circuits, End effectors, Various types of Grippers, Design consideration in vacuum and other methods of gripping, PD and PID feedback actuator models.

UNIT III MANIPULATORS AND BASIC KINEMATICS 9
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic problems, Inverse Kinematic problems, Solutions of Inverse Kinematic problems.

UNIT IV POWER SOURCE AND SENSORS 9
Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors, laser range finder, variable speed arrangements, path determination- Machinery vision, Ranging – LASER – Acoustic , Magnetic fibre optic and Tactile sensor.

UNIT V ROBOTICS IN MEDICINE 9
Da Vinci Surgical SYSTEM, Image guided robotic system for local ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump CABG surgery, Urologic applications, Cardiac surgery, Neurosurgery, Paediatric, and general – Surgery, Gynaecologic Surgery, General Surgery and Nano robotics.

 L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS
 1 Nagrath and Mittal," Robotics and Control", Tata McGraw-Hill, First edition, 2003.
 2 Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons, First edition, 2008.
 3 Fu.K.S. Gonzalaz.R.C., Lee C.S.G," Robotics Control", sensing, Vision and Intelligence, Tata McGraw Hill International, First edition, 2008.

REFERENCES
 1 Howie Choset, kevin Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki and Sebastian Thurn, "Principles of robot motion: Theory, Algorithms, and Implementations", Prentice hall of India, First edition, 2005.
 2 Philippe Coiffet, Michel chirouze, "An Introduction to Robot Technology", Tata McGraw-Hill, First Edition, 1983.
 3 Jacob Rosen, Blake Hannaford & Richard M Satava, "Surgical Robotics: System Applications &Visions", Springer 2011.

COURSE OUTCOMES
At the end of the course student should be able to:
 CO1 Explain the basic concepts of robots and types of robots
 CO2 Analyze applications of robot in the medical field
 CO3 Discuss various types of sensors and power sources
 CO4 Acquire knowledge on kinematics problems
 CO5 Discuss on the types of actuators.

16BMOE3   **TROUBLESHOOTING OF MEDICAL INSTRUMENTS**   L   T   P   C
                                                                      3   0   0   3

UNIT I   FUNDAMENTAL TROUBLESHOOTING PROCEDURES   9

Making of an Electronic Equipment, Causes of Equipment Failure, Troubleshooting Process &Fault finding Aids, Troubleshooting Techniques, Grounding systems in Electronic Equipment, Temperature Sensitive Intermittent Problems, and Correction Action to repair the Equipment.

UNIT II   TESTING OF PASSIVE COMPONENTS & SEMICONDUCTOR   9
**   DEVICES**

Testing: Resistor, Capacitor & Inductors, Causes of failure for electronic components, testing procedure for semiconductor devices: special diodes, bipolar transistors, field effect transistor (FET), and thyristor.

UNIT III   FAULT DIAGNOSIS IN ANALOG & DIGITAL INTEGRATED   9
**   CIRCUITS**

Fault Diagnosis in Op-Amp Circuits, Digital Troubleshooting Methods, Digital IC Trouble-shooters, Circuit board Troubleshooting.

UNIT IV   BIOMEDICAL EQUIPMENT TROUBLESHOOTING-I   9

Trouble shooting of ECG Machine, EEG Machine, Defibrillator Electrosurgical unit, anaesthesia machine, Autoclaves & sterilizers, Endoscope.

UNIT V   BIOMEDICAL EQUIPMENT TROUBLESHOOTING-II   9

Troubleshooting of Incubators, Nebulizer, Oxygen concentrators, Oxygen cylinders & flow metes, Pulse Oximeter, Sphygmomanometers, Suction Machine, X-Ray Machine Troubleshooting.

L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS

   1   Khandpur R S, "Troubleshooting Electronic Equipment – Includes Repair & Maintenance", Tata McGraw –Hill , Second edition 2009.
   2   Dan Tomal& Neal Widmer, "Electronic Troubleshooting", McGraw Hill, 3rd Edition 2004.

REFERENCES

   1   Nicholas Cram &selby Holder," Basic Electronic Troubleshooting for Biomedical Technicians", TSTC Publishing, 2nd Edition 2010.
   2   World Health Organisation, "Maintenance & Repair of laboratory, Diagnostic imaging & Hospital Equipment", Geneva 1994.
   3   Ministry of health & family welfare."Medical Equipment Maintenance Manual-A first line maintenance guide for end users", New Delhi, October 2010.

COURSE OUTCOMES

At the end of the course student should be able to:

   CO1   Troubleshoot various equipments used in hospitals
   CO2   Diagnosis the problems in hospitals equipments
   CO3   Provide adequate technical information on operating principles of medical instruments
   CO4   Attain mastery in fault detection and corrective measures
   CO5   Explain the making of an electronic equipment

16BMOE4   **RESEARCH METHODOLOGIES AND BIO ETHICS**   **L**   **T**   **P**   **C**
                                                              3   **0**   **0**   **3**

UNIT I   INTRODUCTION   9
Definition of Research, Qualities of Research, Components of Research problem, Various Steps in Scientific Research, Types of Research; Hypotheses Research Purposes-Research design- Survey Research- Case Study Research

UNIT II   DATA COLLECTION, ANALYSIS & EVALUATION   9
Sources of Data, Procedure Questionnaire- Sampling Merits and Demerits – Experiments- Procedure; Introduction to Statistics-Probability Theories; Hypothesis Tests; Correlation and Regression analysis.

UNIT III   RESEARCH REPORTS   9
Structure and Components of Research Report, Type of Report, Good Research Report, Pictures and Graphs.

UNIT IV   BIOETHICS   9
Definition ,Concepts, Ethical issues in clinical trial for medical devices, Ethical issues in clinical trials for animal testing for medical devices, Ethical issues in design and manufacture –Cost benefit analysis-Professional restriction and professional responsibility –rights of engineers, Conflict of interest, Ethics in genetic engineering and testing allocation of scarce resources, Codes of ethics for bio engineers, Ethics of implant use and marketing, Ethical issues in tissue engineering.

UNIT V   VIDEOS & CASE STUDY   9
Videos- The insider-Cracking the code of life- A right to die-Challenger disaster, Case Study-Tuskeegee study-Taxol case study – Nuremberg trial- Bjak – Shiley heart valve failure case study, Informed Consent, Ethics Committee.

                                 L : 45   T: 0   P: 0   Total: 45 PERIODS

TEXT BOOKS
1. Kothari C R, "Research Methodology: Methods and Techniques", Wiley Eastern Publication, 1990.
2. Daniel A Vallero, "Biomedical ethics for Engineers", Elsevier publication, 2007.

REFERENCES
1. Glantz SA., "Primer of Biostatistics" McGraw Hill New York 4th Edition, 1997

COURSE OUTCOMES
At the end of the course student should be able to:
- **CO1**   Understand the purpose of research
- **CO2**   Analyze and evaluate the collection of data
- **CO3**   Explain the medical ethics
- **CO4**   Make reports of the research and case study
- **CO5**   Evaluate the failure and cause of them

16BMOC1   **MEDICAL TEXTILES**

UNIT I   INTRODUCTION TO MEDICAL TEXTILES   6
Medical textile products and their applications - sutures - bandages - surgical implants - non-surgical implants - extracorporeal devices - health care products - hygiene product - non-woven technology - medical textile testing.

UNIT II   COATING OF MEDICAL TEXTILES   4
Fabric coating: properties - polymer coatings - coating methods - medical applications -lamination: methods and applications.

UNIT III   FACE MASK   3
Safety issues, effectiveness, types, recommendations, production & testing.

UNIT IV   ELECTROSPUN NANOMEMBRANES FOR MEDICAL   2
**   APPLICATIONS**
Process, parameters, polymers used & medical applications

Total: 15 PERIODS

TEXT BOOKS
1   Volkmar T. Bartels, "Handbook of Medical Textiles", Wood head Publishing, 2011.
2   Subhash Anand, "Medical textiles and biomaterials for healthcare", Wood head, 2006.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Understand the importance of medical textile products and their applications
CO2   Learn the Fabric coating and their properties

16BMOC2   **INTRODUCTION TO NANOTECHNOLOGY**

UNIT I   NANOMATERIALS FABRICATION AND CHARACTERIZATION   6

Top- down processes, lithography, etching - bottom-up process, vapor phase deposition methods, molecular beam epitaxy, self-assembly and self-organization. Characterization methods: scanning electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, raman spectroscopy.

UNIT II   INORGANIC NANO STRUCTURES   4

Quantum confinement in semiconductor nanostructures, quantum wells, quantum wires, quantum dots, super lattices.

UNIT III   NANODEVICES AND THEIR APPLICATIONS   5

Nanomagnetic materials, carbon nanotubes, organic field effect transistor, organic light emitting diodes, organic photovoltaics, injection lasers, optical memories.

Total: 15 PERIODS

TEXT BOOKS

1   Pradeep T, "Nano: The essentials, understanding nanoscience and nanotechnology", Tata McGraw Hill, New Delhi, 2007.
2   Chris Binns, " Introduction to nanoscience and nanotechnology," John Wiley & Sons, New Jersey, 2010
3   Chris Binns, " Introduction to nanoscience and nanotechnology," John Wiley & Sons, New Jersey, 2010
4   Sami Franssila, "Introduction to micro fabrication", John Wiley & Sons, UK, 2010

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Understand the nanomaterials fabrication process
CO2   Identify the Nanodevices and their applications

16BMOC3   **PROFESSIONAL VALUES AND BIOETHICS**

UNIT I   PROFESSIONAL VALUES   2
Meaning - significance of values - human values - universal values.

UNIT II   APPLICATION OF VALUES   2
Relevance of values in management - values for manager - personal values and organizational commitment.

UNIT III   BUSINESS ETHICS IN INDIA   2
Business ethics - ethics and social responsibility - ethical leadership in business - corporate code of ethics - Indian ethos and corporate governance - case study.

UNIT IV   ETHICAL DILEMMA   2
Ethical reasoning - conflict of interest - resolving ethical dilemma - ethical decision model - causes of unethical behaviour.

UNIT V   BIOETHICS   7
History of bioethics - concepts - ethical issues: clinical trials, animal trials - informed consent - review process - ethics committee composition - case study - evaluation.

Total: 15 PERIODS

TEXT BOOKS
1   Nanadagopal R and Ajith Sankar R.N, "Indian Ethos and Values in Management", Tata McGraw Hill, New Delhi, 2010.
2   Fernando A C, "Business Ethics an Indian Perspective", Pearson Education, London, 2009
3   Daniel A Vallero, "Biomedical ethics for engineers", Academic Press, Elsevier INC, USA, 2007.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Understand the significance of human values
CO2   Understand the concepts of ethics and social responsibility

16BMOC4   **INTRODUCTION TO MEMS**

UNIT I   **OVERVIEW OF MEMS AND MICROSYSTEMS**   **1**
Introduction - microsystems and microelectronics - microsystems and miniaturization - applications.

UNIT II   **MATERIALS FOR MEMS AND MICROSYSTEMS**   **2**
Introduction - substrates and wafers - silicon and silicon compounds in MEMS - packaging materials.

UNIT III   **MICROSYSTEM FABRICATION PROCESS**   **4**
Photolithography - chemical vapour deposition - physical vapour deposition - etching.

UNIT IV   **OVERVIEW OF MICROMANUFACTURING**   **3**
Bulk and surface micromachining.

UNIT V   **MICRO SYSTEM DESIGN**   **1**
Design of MEMS pressure sensor.

UNIT VI   **PACKAGING**   **4**
Introduction - mechanical packaging - microsystem packaging - interfaces in microsystem packaging - essential packaging technologies.

                                         Total: 15 PERIODS

TEXT BOOKS
1. Tai-Ran Hsu, "MEMS & Microsystems: Design and Manufacture and Nanoscale Engineering", John Wiley & Sons Inc, USA, 2008.
2. James J. Allen, "Micro Electro Mechanical System Design", Taylor & Francis, USA, 2005.
3. Chang Liu, "Foundations of MEMS", Pearson Education Inc, USA, 2006.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1   Understand the overview of MEMS and Microsystems
CO2   Understand the overview of Micro Manufacturing

16BMOC5   **ISO 9001 STANDARDS**

UNIT I   HISTORY OF THE STANDARD   3
Key definitions related to QMS - clause 4.0 - requirements, review.

UNIT II   CLAUSE 5.0   3
Requirements, briefing of the case study - exercise covering 4.0/ 5.0.

UNIT III   CLAUSE 6.0   3
Requirements, procedure preparation - typical documentation requirements - exercise on clause 6.0.

UNIT IV   PROCEDURE PREPARATION   3
Typical documentation requirements - exercise on Clause 6.0, review.

UNIT V   CLAUSE 7.0   2
Requirements, discussion on questionnaire, exercise covering 7.0.

UNIT VI   Presentation and discussion on case study   **1**

Total: 15 PERIODS

TEXT BOOKS
1 "ISO 9001: 2008 Quality Management System - Requirements", Bureau of Indian Standards, 2008.
2 "ISO 9000: 2005 Quality Management System - Fundamentals and Vocabulary", Bureau of Indian Standards, 2005.
3 "ISO 9004: 2000 Quality Management System - Guidelines for performance improvement", Bureau of Indian Standards, 2000.

COURSE OUTCOMES
At the end of the course student should be able to:
CO1 Understand the basics of Quality Management System
CO2 Learn the typical documentation requirements and preparation

16BMOC6   IOT IN HEALTHCARE

UNIT I   HISTORY OF IOT   3
Introduction to IOT – History of IOT – Need and role of IOT in healthcare
UNIT II   SMART HEALTHCARE   2
Technologies of IoT in healthcare- Perspective Analysis- Opportunities
UNIT III   INFORMATION TECHNOLOGY   3
EMR (Electronic Medical Recording) – Challenges – Future vision of healthcare in IT
UNIT IV   CONVERGENCE TECHNOLOGIES IN HEALTHCARE   4
Medical devices – Wearables and IOT – Biometrics – Reliability of IOT in healthcare process
UNIT V   IOT IN HOSPITAL MANAGEMENT   3
Role of time in health IOT – Paperless hospital – Telemedicine and E health

Total: 15 PERIODS

TEXT BOOKS
  1   Internet of Things from research and innovation to market development, Dr.Ovidiu Vermesan, Dr.Peter Friess, River Publishers

COURSE OUTCOMES
At the end of the course student should be able to:
  CO1   Understand the need of IOT in healthcare
  CO2   Determine the advantages of IOT in healthcare

16BMOC7   **HOSPITAL FURNITURE**

UNIT I	**INTRODUCTION TO HOSPITAL FURNITURE**	**2**

Introduction to hospital furniture- Monitor trolly

UNIT II	**OT FURNITURE**	**5**

Crash cart-Surgeon chair-Instrument trolley-Swab rack-Emergency trolley

UNIT III	**STRETCHER**	**4**

Introduction to stretcher-Wheeled stretcher-Convertible Stretcher

UNIT IV	**WHEELCHAIR**	**4**

Introduction to wheel chair-Manual wheel chair-Automated wheel chair

Total: 15 PERIODS

TEXT BOOKS

  1   A source of design reference standards, "Handbook to build a hospital", French red cross, 2006.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1   Distinguish the different types of hospital furniture

CO2   Determine the various furniture uses and its application