VELALARCOLLEGEOFENGINEERINGANDTECHNOLOGY

(Autonomous)

Thindal, Erode-638012

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai) (Accredited by NAAC with 'A+' grade)



REGULATIONS 2022

CURRICULUM

BE-MEDICAL ELECTRONICS

Choice Based Credit System (CBCS)



VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)

DepartmentMedical ElectronicsProgrammeBE-Medical Electronics

Regulations 2022 (Incorporating Relative Grading System)

SUMMARY OF CREDITS												
				C	redits	per Se	emeste	r			Credita	Credits as
S.No	Course Category	Ι	п	ш	IV	v	VI	VII	VIII	Total Credit s	in %	Per AICTE Model Curriculum
1	HS	4	4	-	-	-	-	4	-	12	8	12
2	BS	11	8	4	-	-	-	-	-	23	14	25
3	ES	8	8	8	7	4	-	-	-	35	21	24
4	PC	-	-	11	15	8	11	6	-	51	31	48
5	PE	-	-	-	I	6	6	6	-	18	11	18
6	OE	-	-	-	-	3	3	3	-	9	6	18
7	EC	-	-	-	-	-	3	-	12	15	9	15
8	MC	✓	~	✓	\checkmark	✓	~	~	-			-
9	VC					✓						-
10	OC, SC, AC					✓						-
Total Sem	Credits/	23	20	23	22	21	23	19	12	163	100	160

HS-Humanities and Social Science

BS - Basic Science

ES -Engineering Science

PC - Professional Core

PE-Professional Elective

OE - Open Elective

EC-Employability Enhancement Course(Project, Seminar, Internship, etc.)

MC - Mandatory Course

VC -Value added course(If three or more credits earned, the non-elective course may be exempted)

OC - Online Course (If six or more credits earned, then two elective courses may be exempted)

SC-Self Study course

AC - Audit Course

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For Minor Degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes,

VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)

CURRICULUM UG

R2022

VCET

Department

MEDICAL ELECTRONICS

Programme BE- Medical Electronics

		SEMESTER	<u>R1</u>							
S.	Course Cod	e Course	ory	P	erioc Wee	ls/ k	lits	Max. Marks		rks
No		Title	Categ	L	Т	Р	Cred	CA	SE	Tot
1	22MCT01	Induction Programme	(°.)	3 We	eks		0	100	0	100
	-	Theory								
2	22ENT11	Communicative English	HS	3	0	0	3	40	60	100
3	22MAT11	Matrices and Differential Equations	BS	3	1	0	4	40	60	100
4	22PHT11	Engineering Physics	BS	3	0	0	3	40	60	100
5	22CYT11	Engineering Chemistry	BS	3	0	0	3	40	60	100
6	22MET11	Engineering Graphics	ES	2	0	4	4	50	50	100
7	22ECT11	Semiconductor DevicesES300				3	40	60	100	
8	22HST11	தமிழர்மரபு (For the students admitted fromAY2023- 24 onwards)	HS	1	0	0	1	40	60	100
	·	Practical								
9	22PHL11	Physics and Chemistry Laboratory-I	BS	0	0	2	1	60	40	100
10	22MEL11	Workshop Practices Laboratory	ES	0	0	2	1	60	40	100
	1	Mandatory					I	I		
11	22MCT02	Universal Human Values	MC	0	0	2	0	100	0	100
		SEMESTED 2		1 ota	I Cro	edits	23			
SEMESTER 2										
C	Commo	SEWIESTER 2		Pe	eriod	ls/	ts	M	w Ma	nlra
S. No	Course Code	Course	ate or	Pe	eriod Weel	ls/ K	redits	Ma	ax. Ma	rks
S. No	Course Code	Course Title	Cate gor	Pe V	eriod Weel T	ls/ k P	Credits	Ma CA	ix. Ma SE	rks Tot
S. No	Course Code	Course Title Professional English	Cate gor	Pe L	eriod Weel T	k P	Credits	Ma CA	x. Ma SE	rks Tot
S. No	Course Code 22ENT21 22MAT21	Course Title Professional English Calculus and Complex Analysis	Cate Sor	Pe L 3	eriod Weel T 0	ls/ k P 0	Credits	Ma CA 40	SE	rks Tot 100
S. No	Course Code 22ENT21 22MAT21 22BMT21	Course Title Theory Professional English Calculus and Complex Analysis Medical Physics	Cate SG Sor	Pe L 3 3	eriod Weel T 0 1	k P 0 0	Credits	Ма СА 40 40	x. Ma SE 60 60	rks Tot 100 100
S. No 1 2 3 4	Course Code22ENT2122MAT2122BMT2122CST11	Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming	Cate SBS SC SC SC SC SC SC SC SC SC SC SC SC SC	Pe L 3 3 3 3	eriod Weel T 0 1 0	k P 0 0 0	3 3 3 3	Ma CA 40 40 40 40	SE 60 60 <t< td=""><td>rks Tot 100 100 100</td></t<>	rks Tot 100 100 100
S. No 1 2 3 4 5	Course Code22ENT2122MAT2122BMT2122CST1122ECT22	Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines	Cate SBS SD ES ES ES	Pe L 3 3 3 3 3 3	eriod Weel T 0 1 0 0 0	k P 0 0 0 0	3 3 3 3	Ma CA 40 40 40 40 40 40	SE 60 60 60 60 60 60 60 60	rks Tot 100 100 100 100
S. No 1 2 3 4 5 6	Course Code22ENT2122MAT2122BMT2122CST1122ECT2222HST11	Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only)	Cate SCH SCA SCA SCA SCA SCA SCA SCA SCA SCA SCA	Pe L 3 3 3 3 3 1	Priod Weel T 0 1 0 0 0 0 0	s/ P 0 0 0 0 0 0 0	3 3 4 3 3 1	Ma CA 40 40 40 40 40 40 40 40 40	SE 60 60 60 60 60 60 60 60 60 60 60	rks Tot 100 100 100 100 100 100
S. No 1 2 3 4 5 6 7	Course Code22ENT2122MAT2122BMT2122CST1122ECT2222HST1122HST21	SENTESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நுட்பமும் (For the students admitted from AY 2023-24 onwards)	Bor Cate Ser Cate Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser Ser	Pe L 3 3 3 3 3 1 1	O T 0 1 0 0 0 0 0 0 0 0 0 0	Is/ K P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3 3 4 3 3 1 1	Ma CA 40 40 40 40 40 40 40 40 40 40 40 40 40 40	x. Ma SE 60 60 60 60 60 60 60	rks Tot 100 100 100 100 100 100 100
S. No 1 2 3 4 5 6 7	Course Code22ENT2122MAT2122BMT2122CST1122ECT2222HST1122HST21	SENIESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நட்பமும் (For the students admitted from AY 2023-24 onwards) Practical	Cate SCA SCA SCA SCA SCA SCA SCA SCA SCA SCA	Pe L 3 3 3 3 1 1	oriod 0 1 0 0 0 0 0 0 0 0 0 0 0	k P 0 0 0 0 0 0 0	3 3 4 3 3 1 1	Ma CA 40 40 40 40 40 40 40 40 40 40 40 40	SE 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60	rks Tot 100 100 100 100 100 100 100 100 100
S. No 1 2 3 4 5 6 7 8	Course Code 22ENT21 22MAT21 22BMT21 22CST11 22ECT22 22HST11 22HST21 22HST21 22HST21	SENIESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II	BS Bor Cate S BS BS BS BS BS BS	Pe L 3 3 3 3 3 1 1 1 0	oriod T 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	k P 0 0 0 0 0 0 0 0 0 2	3 3 4 3 3 1 1 1	Ma CA 40 40 40 40 40 40 40 60	SE 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 40	rks Tot 100 100 100 100 100 100 100 100 100 10
S. No 1 2 3 4 5 6 7 7 8 9	Course Code 22ENT21 22MAT21 22BMT21 22CST11 22ECT22 22HST11 22HST21 22HST21 22HST21 22ECT22 22HST21 22ECT22	SEMIESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II Electric Circuits and Electron Devices Laboratory	BS BS BS BS BS BS BS BS BS ES	Pe L 3 3 3 3 3 1 1 1 0 0	oriod T 0 1 0	Is/ R 0 0 0 0 0 0 0 0 0 0 0 2 2	3 3 4 3 3 1 1 1 1	Ma CA 40 40 40 40 40 40 40 40 60 60	x. Ma SE 60 60 60 60 60 60 60 60 40 40	rks Tot 100 100 100 100 100 100 100 10
S. No 1 2 3 4 5 6 7 7 8 9 10	Course Code22ENT2122MAT2122BMT2122CST1122ECT2222HST1122HST2122PHL2122ECL2222CSL11	SENIESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II Electric Circuits and Electron Devices Laboratory Python Programming Laboratory	BS BS BS BS BS BS BS BS BS BS BS BS BS B	Pe L 3 3 3 3 1 1 1 0 0 0	oriod 0 1 0	Is/ R 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2	3 3 4 3 3 1 1 1 1 1 1	Ma CA 40 40 40 40 40 40 60 60 60	SE 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 40 40 40	rks Tot 100 100 100 100 100 100 100 10
S. No 1 2 3 4 5 6 7 7 8 9 10 10	Course Code22ENT2122MAT2122BMT2122CST1122ECT2222HST1122HST2122PHL2122ECL2222CSL1122CSL1122CSL11	SENTESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நுட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II Electric Circuits and Electron Devices Laboratory Python Programming Laboratory Python Programming Laboratory (For the students	BS ES HS ES HS HS HS ES ES ES ES ES ES	Pe L 3 3 3 3 3 1 1 1 0 0 0 0 0 0	oriod T 0 1 0	Is/ R 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2 2 2 2 2	3 3 4 3 3 3 1 1 1 1 1 1 1 1	Ma CA 40 40 40 40 40 40 40 60 60 60 60 60	x. Ma SE 60 40 40 40 40	rks Tot 100 100 100 100 100 100 100 10
S. No 1 2 3 4 5 6 7 7 8 9 10 10	Course Code 22ENT21 22MAT21 22BMT21 22CST11 22HST11 22HST21 22HST21 22LST21 22LST21	SENIESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II Electric Circuits and Electron Devices Laboratory Python Programming Laboratory Python Programming Laboratory (For the students admitted from AY2024- 25 onwards)	BS BS BS BS BS BS BS BS BS ES ES ES ES ES	Pe L 3 3 3 3 3 1 1 1 0 0 0 0 0	oriod 0 1 0	Is/ R 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2	3 3 4 3 3 1 1 1 1 1 1 1 1	Ma CA 40 40 40 40 40 40 60 60 60 60 60 60	x. Ma SE 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 40 40 40 40 40	rks Tot 100 100 100 100 100 100 100 100 100 10
S. No 1 2 3 4 5 6 7 8 9 10 10 10	Course Code 22ENT21 22MAT21 22BMT21 22CST11 22ECT22 22HST11 22HST21 22ECT22 22HST11 22ECT21 22HST11 22ECT21 22HST11 22ECL22 22CSL11 22CSL11 22CSL11	Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் துட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II Electric Circuits and Electron Devices Laboratory Python Programming Laboratory Python Programming Laboratory (For the students admitted from AY2024- 25 onwards)	BS ES ES ES ES ES ES ES ES ES	Pe L 3 3 3 3 3 1 1 1 0 0 0 0 0	oriod 0 1 0	Is/ R 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 0	3 3 4 3 3 1 1 1 1 1 1 1 1	Ma CA 40 40 40 40 40 40 60 60 60 60 60 60 60 60	x. Ma SE 60 60 60 60 60 60 60 40 40 40 40 40 60 60 60 60 60 60 60 60 60 60 60 60 60	rks Tot 100 100 100 100 100 100 100 100 100 10
S. No 1 2 3 4 5 6 7 8 9 10 10 11	Course Code 22ENT21 22MAT21 22BMT21 22CST11 22HST11 22HST21 22HST21 22ECL22 22ECL22 22CSL11 22CSL11 22CSL11 22CSL11 22CSL11 22CSL11 22CSL11 22CSL11	SEMESTER 2 Course Title Theory Professional English Calculus and Complex Analysis Medical Physics Python Programming Electric Circuits and Machines தமிழர்மரபு (For Students admitted in AY2022-23 only) தமிழரும் தொழில் நட்பமும் (For the students admitted from AY 2023-24 onwards) Practical Physics and Chemistry Laboratory-II Electric Circuits and Electron Devices Laboratory Python Programming Laboratory Python Programming Laboratory (For the students admitted from AY2024- 25 onwards) Mandatory Environmental Science and Engineering	BS BS ES ES HS HS HS ES ES ES ES ES ES ES	Pe L 3 3 3 3 3 1 1 1 0 0 0 0 0 0 0 2	oriod Weel T 0 1 0	Is/ R 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 0	3 3 4 3 3 1 1 1 1 1 1 1 1 0	Ma CA 40 40 40 40 40 40 60 60 60 60 60 100	x. Ma SE 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 60 40 40 40 40 0	rks Tot 100 100 100 100 100 100 100 100 100 10

		SEMESTER 3								
s			tegory	Periods/ Week		ls/ K	redits	Max. Marks		
No	Course Code	Course Title	Ca	L	Т	Р	CI	CA	SE	Tot.
		Theory								
1	22MAT32	Transform Techniques and Probability Theory	BS	3	1	0	4	40	60	100
2	22MDT31	Bio Sciences	PC	3	0	0	3	40	60	100
3	22MDT32	Anatomy and Human Physiology	PC	3	0	0	3	40	60	100
4	22MDT33	Sensors and Measurements	PC	3	0	0	3	40	60	100
5	22ITT21	C Programming	ES	3	0	0	3	40	60	100
6	22MDT34	Analog and Digital Electronics ES 3 1			1	0	4	40	60	100
7	22HST21	தமிழரும் தொழில் நட்பமும் (For Students admitted in AY 2022- 23 only)	HS	1	0	0	1	40	60	100
		Practical								
8	22MDL31	Bio Sciences Laboratory	PC	0	0	2	1	60	40	100
9	22MDL32	Sensors and Measurements Laboratory	PC	0	0	2	1	60	40	100
10	22ITL21	C Programming Laboratory	ES	0	0	2	1	60	40	100
		Mandatory				-		-	-	-
11	22MCL04	English for Professionals	MC	0	0	2	0	100	0	100
11	22MCL04	English for Professionals(For the students admitted from AY 2023- 24 onwards)	MC	0	0	2	0	100	0	100
			,	Tota	Cre	dits	23			

	SEMESTER 4									
S.	Course Code	Course Title	egory	Periods/ Week		ls/ k	edits	Max. Marks		
NO			Cat	L	Т	Р	Cr	CA	SE	Tot.
		Theory								
1	22MDT41	Medical Equipment-I	PC	3	0	0	3	40	60	100
2	22MDT42	Bio Control Systems	PC	3	1	0	4	40	60	100
3	22MDT43	Linear and Digital Integrated Circuits	ES	3	0	0	3	40	60	100
4	22MDT44	Radiological Equipment	PC	C 3 0 0			3	40	60	100
5	22MDC41	Signal Processing in Healthcare	PC	3	0	2	4	50	50	100
6	22MDT45	Communication Systems	ES	3	0	0	3	40	60	100
		Practical								
				_	-	-				
7	22MDL41	Bio Medical Instrumentation Laboratory	PC	0	0	2	1	60	40	100
8	8 22MDL42 Linear and Digital Integrated Circuits Laboratory ES 0 0 2		2	1	60	40	100			
				Tota	al Cr	edits	22			

	SEMESTER 5										
S.	Course Code	Course Title	legory	Period Weel		ls/ K	edits	Max. Marks		rks	
INO			Cat	L	Т	Р	Cr	CA	SE	Tot.	
	-	Theory									
1	22MDT51	Medical Equipment-II	PC	3	0	0	3	40	60	100	
2	22MDC51	Microprocessor and Embedded Controllers	PC	3	0	2	4	50	50	100	
3	22ITT54	Java Programming	ES	3	0	0	3	40	60	100	
4		Professional Elective-I	PE	3	0	0	3	40	60	100	
5		Professional Elective -II	PE	3	0	0	3	40	60	100	
6		Open Elective-I	OE	3	0	0	3	40	60	100	
		Practical									
7	22MDL51	Diagnostic and Therapeutic Equipment Laboratory	PC	0	0	2	1	60	40	100	
8	22ITL53	Java Programming Laboratory	ES	0	0	2	1	60	40	100	
		Mandatory	-								
9	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100	
1022MCL06Communication Skills LaboratoryMC0020100				0	100						
	Total Credits 21										

		SEMESTER 6								
S.	Course Code	Course Title	egory	Pe	Periods/ Week		edits	Max. Marks		
INO			Cat	L	Т	Р	Cr	CA	SE	Tot.
	Theory									
1	22MDT61	Medical Image Processing	PC	3	0	0	3	40	60	100
2	22MDT62	Rehabilitation Engineering	PC	3	0	0	3	40	60	100
3	22MDT63	Healthcare Analytics	PC	3	0	0	3	40	60	100
4		Professional Elective -III	PE	3	0	0	3	40	60	100
5		Professional Elective -IV	PE	3	0	0	3	40	60	100
6		Open Elective-II	OE	3	0	0	3	40	60	100
7	22MDT64	Medical Coding	PC	1	0	0	1	40	60	100
		Practical								
8	22MDL61	Medical Image Processing Laboratory	atory PC 0 0				1	60	40	100
9 22MDL62 Mini Project EC 0 0 6						6	3	40	60	100
Total Credits										

	SEMESTER 7										
S.	Course Code	Course Title	tegory	Pe	eriod Weel	s/ K	edits	Max. Marks		rks	
INO			Cat	L	Т	Р	Cr	CA	SE	Tot.	
	Theory										
1	22MDT71	Artificial Intelligence and Machine Learning	PC	3	0	0	3	40	60	100	
2	22ITT71	Economics and Management for Engineers	HS	3	0	0	3	40	60	100	
3		Professional Elective-V	PE	3	0	0	3	40	60	100	
4	4 Professional Elective-VI PE				0	0	3	40	60	100	
5		Open Elective-III	OE	3	0	0	3	40	60	100	
6	22HST71	Human Values and Professional Ethics	HS	1	0	0	1	40	60	100	
		Practical									
7	22MDL71	Medical Artificial Intelligence Laboratory	PC	0	0	2	1	60	40	100	
8	22MDL72	Hospital Training	PC	0	0	4	2	60	40	100	
		Mandatory									
9	22MCT07	Indian Constitution and Traditional Knowledge	HS	2	0	0	0	100	0	100	
	Total Credits 19										

		SEMESTER 8								
S.	Course	Course Title	legory	Periods/		Periods/ Week		Μ	ax. Ma	rks
INO	Code		Cat	L	Т	Р	Cr	CA	SE	Tot.
		Practical								
1	22MDL81	Internship	EC	-	-	-	2	100	0	100
2	22MDL82	Project Work	EC	0	0	20	10	40	60	100
				Tot	tal Cr	edits	12			
	Total Programme Credits163									

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1	VERTICAL 2	VERTICAL 3	VERTICAL 4	VERTICAL 5	VERTICAL 6
Healthcare 4.0	Medical System Design	Innovation and Product Development	Healthcare Management	Signal and Image Processing	ICT for Healthcare
Haptics	Medical Device Design	Foundation Skills in Integrated Product Development	Hospital Planning and Management	Bio signal Processing	Medical Informatics
Medical Optics and Photonics	BioMEMS	Patient Safety Standards and Ethics	Health Management Information Systems	Speech and Audio Signal Processing	Wearable Devices
Rapid Prototyping	Assistive Devices	Medical Device Regulations	Medical Waste Management	Computer Vision	Tele health Technology
Ergonomics for Healthcare	ICU and OT Equipment	Electrical Safety and Quality Assurance	Medical Ethics And Standards	Medical Imaging Systems	IOT in Healthcare
AI in Healthcare	Analytical Instrumentation	Medical Innovation and Entrepreneurship	Forensic Science in Healthcare	Brain Computer Interface and Applications	Cloud Computing for Healthcare
Robotics and Automation in Healthcare	Medical Equipment Maintenance and Troubleshooting	Intellectual Property Rights	Biostatistics	Biometric Systems	Augmented Reality and Virtual Reality in Healthcare
Physiological Modeling	Medical Device Packaging	Applied Design Thinking	Digital Healthcare Technologies	Pattern Recognition and Neural Networks	Cyber Security for Medical Systems

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B. Tech (Honours) or Minor degree also.

	PROFESSIONAL ELECTIVE COURSES: VERTICALS										
S.	Course Code	Course Title	tegory	P	erioo Wee	ls/ k	redits	М	Max. Marks		
No			Ca	L	Т	Р	Ū	CA	SE	Tot.	
		VERTICAL 1 HEALTHCARI	E 4.0			T					
1	22MDE11	Haptics	PE	3	0	0	3	40	60	100	
2	22MDE12	Medical Optics and Photonics	PE	3	0	0	3	40	60	100	
3	22MDE13	Rapid Prototyping	PE	3	0	0	3	40	60	100	
4	22MDE14	Ergonomics for Healthcare	PE	3	0	0	3	40	60	100	
5	22MDE15	AI in Healthcare	PE	3	0	0	3	40	60	100	
6	22MDE16	Robotics and Automation in Healthcare	PE	3	0	0	3	40	60	100	
7	22MDE17	Physiological Modeling	PE	3	0	0	3	40	60	100	
		VERTICAL 2 MEDICAL SYS	TEM D	ESIC	GN	r	1		1	1	
1	22MDE21	Medical Device Design	PE	3	0	0	3	40	60	100	
2	22MDE22	BioMEMS	PE	3	0	0	3	40	60	100	
3	22MDE23	Assistive Devices	PE	3	0	0	3	40	60	100	
4	22MDE24	ICU and OT Equipment	PE	3	0	0	3	40	60	100	
5	22MDE25	Analytical Instrumentation	PE	3	0	0	3	40	60	100	
6	22MDE26	Medical Equipment Maintenance and Troubleshooting	PE	3	0	0	3	40	60	100	
7	22MDE27	Medical Device Packaging	PE	3	0	0	3	40	60	100	
		VERTICAL 3 INNOVATION AND PROD	UCT I	DEVI	ELO	PME	NT		1	1	
1	22MDE31	Foundation Skills in integrated product Development	PE	3	0	0	3	40	60	100	
2	22MDE32	Patient safety, Standards and Ethics	PE	3	0	0	3	40	60	100	
3	22MDE33	Medical Device Regulations	PE	3	0	0	3	40	60	100	
4	22MDE34	Electrical Safety and Quality Assurance	PE	3	0	0	3	40	60	100	
5	22MDE35	Medical Innovation And Entrepreneurship	PE	3	0	0	3	40	60	100	
6	22MDE36	Intellectual Property Rights	PE	3	0	0	3	40	60	100	
7	22MDE37	Applied Design Thinking	PE	3	0	0	3	40	60	100	
	1	VERTICAL 4 HEALTH CARE MAN	AGEM	IEN]	[I	1		1		
1	22MDE41	Hospital Planning and Management	PE	3	0	0	3	40	60	100	
2	22MDE42	Health Management Information Systems	PE	3	0	0	3	40	60	100	
3	22MDE43	Medical Waste Management	PE	3	0	0	3	40	60	100	
4	22MDE44	Medical Ethics And Standards	PE	3	0	0	3	40	60	100	
5	22MDE45	Forensic Science in healthcare	PE	3	0	0	3	40	60	100	
6	22MDE46	Biostatistics	PE	3	0	0	3	40	60	100	
7	22MDE47	Digital Healthcare Technologies	PE	3	0	0	3	40	60	100	

	VERTICAL 5 SIGNAL AND IMAGE PROCESSING										
1	22MDE51	Bio signal Processing	PE	3	0	0	3	40	60	100	
2	22MDE52	Speech and audio signal Processing	PE	3	0	0	3	40	60	100	
3	22MDE53	Computer Vision		3	0	0	3	40	60	100	
4	22MDE54	Medical Imaging Systems	PE	3	0	0	3	40	60	100	
5	22MDE55	Brain Computer Interface and Applications	PE	3	0	0	3	40	60	100	
6	22MDE56	Biometric Systems	PE	3	0	0	3	40	60	100	
7	22MDE57	Pattern Recognition and Neural Networks	PE	3	0	0	3	40	60	100	
	•	VERTICAL 6 ICT FOR HEALT	H CAR	E							
1	22MDE61	Medical Informatics	PE	3	0	0	3	40	60	100	
2	22MDE62	Wearable Devices	PE	3	0	0	3	40	60	100	
3	22MDE63	Tele health Technology	PE	3	0	0	3	40	60	100	
4	22MDE64	IOT in Healthcare	PE	3	0	0	3	40	60	100	
5	22MDE65	Cloud Computing for Healthcare		3	0	0	3	40	60	100	
6	22MDE66	Augmented Reality and Virtual Reality in Healthcare	PE	3	0	0	3	40	60	100	
7	22MDE67	Cyber Security for Medical Systems	PE	3	0	0	3	40	60	100	

VERTICALS FOR MINOR DEGREE-(In addition to all the verticals of other programmers)

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
Fin tech	Entrepreneurship	Public	Business Data	Environmental	Artificial
and Block		Administration	Analytics	and	Intelligence
Chain				Sustainability	
Financial	Foundations of	Principles of	Statistics for	Sustainable	Introduction
Management	Entrepreneurship	Public	Management	infrastructure	to Data
		Administration		Development	Science
Fundamentals of	Team Building	Constitution of	Data mining for	Sustainable	Principles
Investment	&Leadership	India	Business	Agriculture and	of Artificial
	Management for		Intelligence	Environmental	Intelligence
	Business			Management	
Banking,	Creativity &	Public Personnel	Human	Sustainable Bio	Data
Financial	Innovation in	Administration	Resource	Materials	Ware
Services and	Entrepreneurship		Analytics		housing
Insurance					and Data
					Mining
Introduction to	Principles of	Administrative	Digital	Materials for	Machine
Block chain	Marketing	Theories	Marketing and	Energy	Learning
and its	Management For		Social	Sustainability	Techniques
Applications	Business		Network		
			Analytics		
Fin tech	Human Resource	Indian	Operation	Green	Expert
Personal	Management for	Administrative	and Supply	Technology	Systems
Finance and	Entrepreneurs	System	Chain		
Payments			Analytics		
Introduction to	Financing New	Public Policy	Financial	Environmental	Cognitive
Fintech	Business Ventures	Administration	Analytics	Quality	Science
				Monitoring	
				and Analysis	
				Integrated	Gamifi
				Energy	cation
-	-	-	-	Planning for	
				Sustainable	
				Development	
				Energy	
-	-	-	-	Efficiency for	-
				Sustainable	
				Development	

	VERTICALS FOR MINOR DEGREE													
S. No	Course Code	Course Title	tegory	F	Perio / We	ods ek	edits	Ma	ax. Ma	rks				
			Ca	L	Т	Р	Cr	CA	SE	Tot.				
		VERTICAL I - FINTECH AND BLO	CKCH	[AIN	J	1								
1	22ITM11	Financial Management	PE	3	0	0	3	40	60	100				
2	2211M12	Fundamentals of Investment	PE	3	0	0	3	40	60	100				
3	22ITM13	Banking, Financial Services and Insurance	PE	3	0	0	3	40	60	100				
4	22ITM14	Introduction to Block chain and its Applications	PE	3	0	0	3	40	60	100				
5	22ITM15	Fin tech Personal Finance and Payments	PE	3	0	0	3	40	60	100				
6	22ITM16	Introduction to Fintech	PE	3	0	0	3	40	60	100				
		VERTICAL II - ENTREPRENEU	JRSHII)	L					L				
1	22MEM21	Foundations of Entrepreneurship	PE	3	0	0	3	40	60	100				
2	22MEM22	Team Building &Leadership Management for Business	PE	3	0	0	3	40	60	100				
3	22MEM23	Creativity& Innovation in Entrepreneurship	PE	3	0	0	3	40	60	100				
4	22MEM24	Principles of Marketing Management For Business	PE	3	0	0	3	40	60	100				
5	22MEM25	Human Resource Management for Entrepreneurs	PE	3	0	0	3	40	60	100				
6	22MEM26	Financing New Business Ventures	PE	3	0	0	3	40	60	100				
		VERTICAL III -PUBLIC ADMINIS	TRAT	[ON										
1	22ECM31	Principles of Public Administration	PE	3	0	0	3	40	60	100				
2	22ECM32	Constitution of India	PE	3	0	0	3	40	60	100				
3	22ECM33	Public Personnel Administration	PE	3	0	0	3	40	60	100				
4	22ECM34	Administrative Theories	PE	3	0	0	3	40	60	100				
5	22ECM35	Indian Administrative System	PE	3	0	0	3	40	60	100				
6	22ECM36	Public Policy Administration	PE	3	0	0	3	40	60	100				
		VERTICAL IV -BUSINESS DATA A	NALY	TIC	S									
1	22CSM41	Statistics for Management	PE	3	0	0	3	40	60	100				
2	22CSM42	Data mining for Business Intelligence	PE	3	0	0	3	40	60	100				
3	22CSM43	Human Resource Analytics	PE	3	0	0	3	40	60	100				
4	22CSM44	Digital Marketing and Social Network Analytics	PE	3	0	0	3	40	60	100				
5	22CSM45	Supply Chain Analytics	PE	3	0	0	3	40	60	100				
6	22CSM46	Financial Analytics	PE	3	0	0	3	40	60	100				

	VERTICAL V- ENVIRONMENTAL AND SUSTAINABILITY 1 22CEM51 Sustainable infrastructure Development DE 2 0 0 2 40 60 100													
1	22CEM51	Sustainable infrastructure Development	PE	3	0	0	3	40	60	100				
2	22CEM52	Sustainable Agriculture and Environmental Management	PE	3	0	0	3	40	60	100				
3	22CEM53	Sustainable Bio Materials	PE	3	0	0	3	40	60	100				
4	22CEM54	Materials for Energy Sustainability	PE	3	0	0	3	40	60	100				
5	22CEM55	Green Technology	PE	3	0	0	3	40	60	100				
6	22CEM56	Environmental Quality Monitoring and Analysis	PE	3	0	0	3	40	60	100				
7	22CEM57	Integrated Energy Planning for Sustainable Development	PE	3	0	0	3	40	60	100				
8	22CEM58	Energy Efficiency for Sustainable Development	PE	3	0	0	3	40	60	100				
	1	VERTICAL VI - ARTIFICIAL INTEI	LIGE	NCE	2									
1	22ADM61	Introduction to Data Science	PE	3	0	0	3	40	60	100				
2	22ADM62	Principles of Artificial Intelligence	PE	3	0	0	3	40	60	100				
3	22ADM63	Data Ware housing and Data Mining	PE	3	0	0	3	40	60	100				
4	22ADM64	Machine Learning Techniques	PE	3	0	0	3	40	60	100				
5	22ADM65	Expert Systems	PE	3	0	0	3	40	60	100				
6	22ADM66	Cognitive Science	PE	3	0	0	3	40	60	100				
7	22ADM67	Gamification	PE	3	0	0	3	40	60	100				

		OPEN ELECTIVES								
S. No	Course	Course Title	ategory	F	Perio / We	ds ek	redits	Ma	ax. Ma	rks
	Coue	OFFEDED BY DEDADTMENT OF MEDICA				P	C	CA	SE	Tot.
1	221/10/001	OFFERED BY DEPARTMENT OF MEDICA				NICS	2	40	60	100
2	22MD001	Introduction 16 Medical Electronics	OE	2 2	0	0	2 2	40	60	100
2	22MD002	Hospital Waste Management	OE	3	0	0	3	40	60	100
3	22MDO03	Hospital Information System	OE	3	0	0	3	40	60	100
4	22MD004	IoT Applications in Healthcare	OE	3	0	0	3	40	60	100
		OFFERED BY DEPARTMENT OF BIO MEDI	CAL E	NGI	INE	ERIN	١G		1	
1	22BMO01	Biometric systems and their applications	OE	3	0	0	3	40	60	100
2	22BMO02	Healthcare Management Systems	OE	3	0	0	3	40	60	100
3	22BMO03	Basics of Bioinformatics	OE	3	0	0	3	40	60	100
4	22BMO04	Biology for Engineers	OE	3	0	0	3	40	60	100
5	22BMO05	Regulatory requirements in Pharmaceutical Industries	OE	3	0	0	3	40	60	100
6	22BMO06	Rapid Prototyping	OE	3	0	0	3	40	60	100
7	22BMO07	Radiotheraphy basics and Applications	OE	3	0	0	3	40	60	100
8	22BMO08	Nanotechnology and Applications								
		OFFERED BY DEPARTMENT OF CIVIL	ENGI	NEF	RIN	IG			•	•
1	22CEO01	Civil and Infrastructure Engineering	OE	3	0	0	3	40	60	100
2	22CEO02	Environmental Pollution and waste management	OE	3	0	0	3	40	60	100
3	22CEO03	Disaster Management and Mitigation	OE	3	0	0	3	40	60	100
4	22CEO04	Building Services	OE	3	0	0	3	40	60	100
	C	DFFERED BY DEPARTMENT OF COMPUTER SCI	ENCE	ANI) EN	IGIN	EER	ING		
1	22CSO01	Foundation of AR/VR	OE	3	0	0	3	40	60	100
2	22CSO02	Web Designing	OE	3	0	0	3	40	60	100
3	22CSO03	Block Chain Fundamentals	OE	3	0	0	3	40	60	100
4	22CSO04	Knowledge Management	OE	3	0	0	3	40	60	100
5	22CSO05	Cloud Computing Essentials	OE	3	0	0	3	40	60	100
	OFFF	CRED BY DEPARTMENT OF ARTIFICIAL INTELI ENGINEERING	LIGEN	CE	ANI	DDA'	TA S	CIENC	E	
1	22ADO01	Fundamentals of Database	OE	3	0	0	3	40	60	100
2	22ADO02	Data Science for Engineers	OE	3	0	0	3	40	60	100
3	22ADO03	Cyber Security	OE	3	0	0	3	40	60	100
4	22ADO04	Data Visualization	OE	3	0	0	3	40	60	100
5	22ADO05	Business Analytics	OE	3	0	0	3	40	60	100

	OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING 1 22EC001 Consumer Electronics OE 3 0 0 3 40 60 100													
1	22ECO01	Consumer Electronics	OE	3	0	0	3	40	60	100				
2	22ECO02	Advanced Mobile Communication	OE	3	0	0	3	40	60	100				
3	22ECO03	Optoelectronics	OE	3	0	0	3	40	60	100				
4	22ECO04	System Design and Applications	OE	3	0	0	3	40	60	100				
5	22ECO05	5G Technologies	OE	3	0	0	3	40	60	100				
	OFFF	ERED BY DEPARTMENT OF ELECTRICAL AND E	ELECT	RO	NIC	S EN	GIN	EERIN	G	L				
1	22EEO01	Domestic and Industrial Electrical Installations	OE	3	0	0	3	40	60	100				
2	22EEO02	Renewable Energy Sources	OE	3	0	0	3	40	60	100				
3	22EEO03	Electric Vehicles	OE	3	0	0	3	40	60	100				
4	22EEO04	Energy Auditing and Conservation	OE	3	0	0	3	40	60	100				
		OFFERED BY DEPARTMENT OF MECHANI	CAL E	NG	INE	ERIN	١G							
1	22MEO01	Industrial Instrumentation	OE	3	0	0	3	40	60	100				
2	22MEO02	Product Design and Development	OE	3	0	0	3	40	60	100				
3	22MEO03	Sustainable Manufacturing	OE	3	0	0	3	40	60	100				
4	22MEO04	Entrepreneurship Development	OE	3	0	0	3	40	60	100				
5	22MEO05	Fundamentals of Ergonomics	OE	3	0	0	3	40	60	100				
6	22MEO06	Principles of Management and Industrial Psychology	OE	3	0	0	3	40	60	100				
7	22MEO07	Safety Measures for Engineers	OE	3	0	0	3	40	60	100				
		OFFERED BY DEPARTMENT OF INFORMAT	ΓΙΟΝ Ί	EC	HNO	OLO	GY							
1	22ITO01	Basics of Java Programming	OE	3	0	0	3	40	60	100				
2	22ITO01	Ethical Hacking	OE	3	0	0	3	40	60	100				
3	22ITO01	E-Commerce and Applications	OE	3	0	0	3	40	60	100				
4	22ITO01	Basics of Android Application Development	OE	3	0	0	3	40	60	100				
5	22ITO01	Web Essentials	OE	3	0	0	3	40	60	100				
6	22ITO01	Digital Video Editing	OE	3	0	0	3	40	60	100				
		OFFERED BY DEPARTMENT OF SCIENCE	AND H	IUN	IAN	ITIE	S							
1	22GEO01	National Cadet Corps Studies-I	OE	3	0	0	3	40	60	100				
2	22GEO02	National Cadet Corps Studies-II	OE	3	0	0	3	40	60	100				

	MANDATORY COURSES													
S. No	Course Code	Course Title	tegory	Р	erio / We	ds ek	edits	Ma	ax. Ma	rks				
			Ca	L	Т	Р	Cr	CA	SE	Tot.				
1	22MCT01	Induction Programme	MC	-	-	-	-	-	-	-				
2	22MCT02	Universal Human Values	MC	0	0	2	0	100	0	100				
3	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100				
4	22MCL04	English for Professionals	MC	0	0	2	0	100	0	100				
5	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100				
6	22MCL06	Communication Skills Laboratory	MC	0	0	2	0	100	0	100				
7	22MCT07	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100				

	OTHER COURSES													
S. No	Course Code	Course Title	tegory	P	Perio / We	ds ek	edits	Ma	ıx. Ma	rks				
			Ca	L	Т	Р	Cr	CA	SE	Tot.				
1	22HST11	தமிழர்மரபு	HS	1	0	0	1	100	0	100				
2	22HST21	தமிழரும் தொழில் நட்பமும்	HS	1	0	0	1	100	0	100				
3	22HST71	Human Values and Professional Ethics	HS	1	0	0	1	100	0	100				

	VALUE ADDED COURSES													
S. No	Course Code	Course Title	tegory	P	Perio / We	ds ek	edits	Ma	ax. Ma	rks				
			Ca	L	Т	Р	Cr	CA	SE	Tot.				
1	22MDV01	Clinical Pathology and Microbiology	VC	0	0	2	1	100	0	100				
2	22MDV02	Calibration and Testing of Medical Devices.	0	2	1	100	0	100						
3	22MDV03	PCB design using Altium Designer/Or CAD/EAGLE.	VC	0	0	2	1	100	0	100				
4	22MDV04	Modelling , Simulation and Analysis of Biological Systems using Lab VIEW	VC	0	0	2	1	100	0	100				
5	22MDV05	Arduino Programming for Health Care Applications.	VC	0	0	2	1	100	0	100				
6	22MDV06	Machine Learning using Matlab/Python.	VC	0	0	2	1	100	0	100				
7	22MDV07	Biomedical Equipment Repair and Maintenance.	VC	0	0	2	1	100	0	100				
8	22MDV08	Development of Assistive Devices for Disabled persons.	VC	0	0	2	1	100	0	100				
9	22MDV09	Development of Healthcare Apps.	VC	0	0	2	1	100	0	100				
10	22MDV10	Designing of Medical Devices using Autodesk Fusion 360.	VC	0	0	2	1	100	0	100				

L- Lecture Period

T-Tutorial Period

P-Practical Period

CA-Continuous Assessment SE-Semester Examination Tot-Total Marks

Category	Credits	Minimum contact periods per week	
Theory	3	3	1 Period = 50
2	4	4	Minutes
Practical	1	2	duration

2MCT01

Preamble:

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. " Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program:

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii)Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty

mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv)Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi)Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

• Guide to Induction program from AICTE

22ENT11

COMMUNICATIVE ENGLISH

(Common to all B.E./B. Tech Programmes) (Students admitted during 2023-24 onwards)

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Listening: Listening for General Information - Specific Details – Conversations - Telephone Conversation - Listening to Voicemail and Messages - Gap Filling Speaking: Self Introduction -Expressing Opinions - Introducing a Friend - Telephone Conversation - Leave a Message - Reading: Reading Brochures and Pamphlets Writing: Writing Reviews - Book/Movie - Writing about Oneself Grammar & Vocabulary: Parts of Speech - Tenses - Contextual Meaning of Words - Abbreviations and Acronyms.

EXPRESSING CASUAL CONVERSATIONS UNIT 2

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry Speaking: Talking about Daily Routine - Talking about Food - Making Conversation using Asking for and Giving Directions - Making an Enquiry - Role Plays - Dialogues Reading: International Recipes - Reading a Print Interview and Answering Comprehension Questions Writing: E- Mail to a Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations Grammar & Vocabulary: Evaluations and Comparisons with Adjectives - Word Formation.

CLARIFICATIONS AND RECOMMENDATIONS UNIT 3

Listening: Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking Speaking: Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD Reading: Articles - Essays drawn from various sources - Note Making Writing: Writing Recommendations - Giving Instructions -Itinerary - Process Description Grammar & Vocabulary: Prepositions - Modifiers - Phrasal Verbs. 9

UNIT 4 PUBLIC SPEAKING AND BUSINESS COMMUNICATION

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech -Answering Multiple Choice Questions Speaking: Welcome Address - Vote of Thanks - Special Address on Specific Topic Reading: Life and Achievements of Famous People Writing: Checklists - Personal Letters Grammar & Vocabulary: Modal Verbs and Probability - Collocations - Fixed Expressions -Semi-Fixed Expressions. 9

WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS UNIT 5

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details Speaking: Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation Reading: Reading Graphical Material for Comparison - Tables - Pie Charts Writing: Writing Definitions – Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Clarifying an Error in the Bill Grammar & Vocabulary: Types of Questions - Use of Discourse Markers - One Word Substitution.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.

REFERENCES:

- M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2nd Edition, New Delhi, 1. 2018.
- 2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.
- J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 3.

LTPC 3003

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2014.

e. RESOURCES :

- 1. <u>https://learnenglish.britishcouncil.org</u>
- 2. https://www.usingenglish.com

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Converse and read fluently using basic grammar components.
- CO2 Communicate through writing without any grammatical errors.
- CO3 Write clear, coherent and organized passages adhering to instructions.
- **CO4** Speak effectively in real-time and business situations.
- **CO5** Enhance vocabulary through listening and reading.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 3	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 5	-	1	-	-	1	1	-	-	2	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MAT11 MATRICES AND DIFFERENTIAL EQUATIONS L 3

(Common to B.E.- BM, EC, EE and MD Programmes)

Preamble

The course aims at achieving conceptual understanding of topics in Differential Calculus, Differential equations and computation of Matrix. The syllabus is designed to provide the skills for modeling engineering problems and understand the role of single variable and multi variables in the discipline of engineering.

UNIT 1 MATRICES

Characteristic equation - Statement and application of Cayley Hamilton Theorem - Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors (without proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms -Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 DIFFERENTIAL CALCULUS

Curvature - Radius, Centre and Circle of curvature in Cartesian and Parametric form - Evolute -Envelope of family of curves with one and two parameters.

UNIT 3 FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives - Differentiation of implicit functions - Jacobian- Properties - Taylor's series expansion for functions of two variables - constrained Maxima and Minima - Lagrange's multipliers with single constraint.

UNIT 4 ORDINARY DIFFERENTIAL EQUATIONS

Linear higher order differential equations with constant coefficients – Particular Integrals for the types: e^{ax} , cosax or sinax, x^n , $e^{ax}V(X)$ – Method of variation of parameters –Applications of differential equations: Simple harmonic motion - Electric circuits (Differential equations and associated conditions need to be given).

UNIT 5 PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Solving partial differential equations of first order: Clairaut's form, Lagrange's linear equation - Solving Linear partial differential equations of second and higher order with constant coefficients of homogeneous type - Particular Integrals for the types:

 $e^{ax+by}, x^m y^n, \sin(ax+by) \operatorname{or} \cos(ax+by), e^{ax+by} V(x, y)$

Lecture : 45, Tutorial : 15, Total : 60

TEXT BOOKS:

- Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New 1. Delhi, 2016.
- 2. George B, Thomas, Joel Hass, Christopher Heil and Maurice D. Weir "Thomas' Calculus". Pearson 14 th Edition, 2018

REFERENCES:

- N.P.Bali, Manish Goyal, "Engineering Mathematics", Lakshmi Publications(Pvt) Ltd,4th 1. Edition, 2014.
- 2. Grewal B.S., "Higher Engineering Mathematics" 43rd Edition, Khanna Publishers, New Delhi, 2014.

e-Resources:

- https://nptel.ac.in/courses/122104018, Mathematics II, Prof. P. Chandra, Prof. A.K. Lal, Prof. V. 1. Raghavendra, Prof. G. Santhanam, IIT Kanpur.
- 2. https://nptel.ac.in/courses/111106139, Laplace Transform, Prof. Indrava Roy, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Determine eigenvalues and eigenvectors of real symmetric matrices and reduce the quadratic form to canonical form by orthogonal transformation.
- Compute curvature, centre of curvature, evolute and envelope of curves. CO2
- Express functions of two variables in Taylor's series and compute Jacobians, maximum and CO3

VCET, B.E-MD, R2022, Curriculum and Syllabus

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minimum values.

- CO4 Solve linear differential equations with constant coefficients and apply them in solving real problems.
- CO5 Compute the solution for the standard forms of linear partial differential equations of first order and solve homogeneous partial differential equations of first and higher order with constant coefficients.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 4	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	1	1	-	-	-	-	-	-	-	1	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

crystal structure and crystal defects. It also describes the physical phenomena related to the above mentioned concepts and their applications in engineering and provides motivation towards innovations.

22PHT11

Preamble

UNIT 1 LASER

Introduction –spontaneous emission and stimulated emission, population inversion, pumping. Einstein's coefficients - derivation. Types of lasers- Nd-YAG-CO₂, Semiconductor lasers (homojunction & heterojunction) – Industrial applications - lasers in welding, heat treatment, cutting- medical applications-holography-construction and reconstruction-Safety classes of laser.

ENGINEERING PHYSICS

(Common to all B.E/B.Tech Programmes)

This course aims to impart the essential concepts of laser, fibre optics, ultrasonics, quantum physics and

UNIT 2 FIBRE OPTICS

Principle and propagation of light in optical fibres – numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – double crucible technique of fibre drawing - splicing, losses in optical fibre, dispersion - fibre optical communication system (Block diagram) - light sources - detectors - fibre optic sensors – temperature & displacement - endoscope.

UNIT 3 ULTRASONICS

Introduction – Production – magnetostriction effect – piezoelectric effect - piezoelectric generatordetection of ultrasonic waves properties – cavitations - velocity measurement – acoustic grating -Industrial applications – drilling, welding, soldering and cleaning – SONAR - non destructive testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, medical applications - sonograms.

UNIT 4 QUANTUM PHYSICS

Black body radiation – Planck's theory (derivation) – deduction of Wien's displacement law and Rayleigh – Jeans' law from Planck's theory – Compton effect - theory and experimental verification – matter waves – Schrödinger's wave equation – time independent and time dependent equations – physical significance of wave function – particle in a one dimensional box.

UNIT 5 CRYSTAL PHYSICS

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 – NaCl, ZnS, diamond and graphite structures – polymorphism and allotropy - crystal defects – point, line and surface defects.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai publishers, 2009.
- 2 Mani Naidu S., "Engineering Physics", 2nd Edition, Pearson Publishing, 2011.

REFERENCES:

- 1. Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 9th Edition, Thomson Brooks Cole, 2013
- 2. Palanisamy P.K., "Engineering Physics", 2nd Edition, Scitech Publications, 2011
- 3. Chitra Shadrach and Sivakumar Vadivelu, "Engineering Physics", 1st Edition, Pearson Education, 2007.

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- 1. <u>http://oupinheonline.com/book/bhattacharya-tandon-engineering-physics</u>/9780199452811.
- 2. <u>https://www.khanacademy.org/science/physics/quantum-physics.</u>

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Compare Nd-YAG, CO₂ and Semiconductor lasers for welding, heat treatment, cutting, medical applications and holography using Stimulated Emission.
- CO2 Demonstrate the knowledge of wave optics using light waves for communication system.
- CO3 Describe the production and applications of ultrasonics.
- CO4 Examine the dual nature of light waves using quantum theory for Black body radiation and Schrodinger's wave equations in particle in a one and three dimensional box.
- CO5 Explain the description of a crystal structure in terms of atom positions, unit cells, and crystal symmetry; and to relate the crystal symmetry to the symmetry observed in a diffraction experiment.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 2	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 3	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 4	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 5	3	2	1	1	1	1	1	-	-	1	1	1	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22CYT11 Preamble

The study of water technology enables engineers to acquire skills to choose the appropriate method of water treatment for industrial and domestic purposes. Electrochemistry and corrosion explain the fundamentals, identification and corrosion prevention for solving electrochemical and corrosion problems. The study of energy storage devices exposes some of the most commonly used energy storage devices. Nanochemistry empowers engineers to acquire knowledge about nanomaterials and their applications in various fields. Polymeric materials aim to equip the engineering students to realize the importance of chemistry in composites and conducting polymers.

ENGINEERING CHEMISTRY

(Common to all B.E/B.Tech Programmes)

UNIT WATER TECHNOLOGY 1

Hardness - types and its units - Boiler troubles - scale and sludge, boiler corrosion, caustic embrittlement, priming and foaming - Internal conditioning - carbonate and calgon conditioning -External conditioning - demineralization process - Desalination - electrodialysis, reverse osmosis -Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods – Ozonisation). 9

UNIT **ELECTROCHEMISTRY AND CORROSION**

2

Electrochemistry - Emf Series and its applications. Metal Finishing - Manufacture of Printed Circuit Board.

Corrosion – mechanism – Galvanic, atmospheric (O₂) and Pitting corrosion. Protective coating – electroplating of nickel and electroless copper plating on printed circuit board.

ENERGY STORAGE DEVICES UNIT 3

Batteries – types – Construction and working of Primary battery – Zinc-Air/carbon, Secondary batteries - Lead-acid battery and Lithium-ion battery, Fuel cells - H₂-O₂ fuel cell and Microbial fuel cell. 9

UNIT NANOCHEMISTRY

4

Nanomaterials – Types – Synthesis – sol-gel and laser ablation – Characterization – Scanning Electron Microscope and Transmission Electron Microscope – Principle and instrumentation (block diagram) – Properties – optical, electrical, mechanical and magnetic and Applications of nanomaterials – medicine, agriculture, electronics and catalysis.

UNIT POLYMERS 5

Polymers - thermoplastics and thermosetting plastics - polymerization - types (definition only) -Compounding of plastics – fabrication – compression and injection – Composites – polymer matrix composites (Fibre reinforced composites) and metal matrix composites - Conduction polymers -General mechanism of conduction in polymers.

TOTAL : 45 PERIODS

TEXT BOOKS:

- Engineering chemistry, 17th Edition. P. C. Jain & Monica Jain, Dhanpat Rai Publishing 1. Company, 2021.
- Applied chemistry, 2nd Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, 2. McGraw Hill Education (India) Private Limited, 2019.

REFERENCES:

- Wiley Engineering Chemistry, 2nd Edition, Wiley, Wiley India Pvt. Ltd, New Delhi, 2014. 1.
- Engineering chemistry, 2nd Edition. O. G. Palanna, McGraw Hill Education (India) Private 2. Limited, New Delhi, 2017.

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3. A Textbook of NanoScience, 2nd Edition, Dr. Rakesh Kumar, Dr. Kamala Pati Tiwary, S. K. Kataria & Sons, New Delhi, 2013.

e-Resources:

- 1. <u>http://nptel.ac.in/courses/113105028/</u>, "Science and Technology of Polymers"- Prof. Basudam Adhikari, Materials Science Centre, IIT Kharagpur
- https://archive.nptel.ac.in/courses/118/102/118102003/, "Nano structured materials-Synthesis,
- 2. Properties, Self-Assembly and Applications" Prof. Ashok K Ganguli, Department of Chemistry, IIT Delhi

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Evaluate the process to purify hard water using internal and external treatment.
- CO2 Apply the principle of electrochemistry in PCB etching and surface coating to prevent corrosion.
- CO3 Compare and contrast the performance of primary, secondary and flow battery.
- CO4 Analyze the characteristics of nanomaterials synthesized by top down and bottom-up process with the aid of SEM and TEM.
- CO5 Categorize the types of polymeric materials and fabrication of plastic by injection and compression molding for engineering applications.

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO2	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO3	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO4	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO5	3	2	2	1	1	1	2	-	1	1	1	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

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Pre-requisites: Basic Geometry

Preamble

The knowledge of Engineering graphics is essential for the Engineering graduates in proposing new product designs through drawings and interpreting data from existing drawings. Engineering Design inculcates into an Engineer the creativity and knowledge on various aspects to be considered while designing and realizing the functional products and processes. This course deals with Engineering curves, orthographic and pictorial projections, sectional views and development of surfaces.

UNIT 1 INTRODUCTION AND PLANE CURVES

Importance of graphics in Engineering applications – Use of drafting instruments – BIS conventions and specifications -Size, layout and folding of drawing sheets - Diagonal scales and vernier scales- Lines, lettering and dimensioning - Basic geometrical constructions (circular and polygonal surfaces). (PRACTICE ONLY AND NOT FOR EXAMINATIONS).

Curves used in Engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT 2 PROJECTION OF POINTS, LINES AND PLANE SURFACES

Orthographic projection- principles-Principal Planes - First angle projection- Projection of points in four quadrants - End point projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method.

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT 3 PROJECTION OF SOLIDS

Projection of simple solids- Cube, prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane and parallel to the other by rotating object method.

UNIT 4 SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position when cut by a cutting plane which is inclined to one of the reference planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids in simple vertical position – Cube, prisms, pyramids, cylinder and cone.

UNIT 5 ISOMETRIC AND FREE HAND SKETCHING

Principles of isometric projection - Isometric scale -Isometric projections of simple solids - Prisms, pyramids, cylinder and cone- Combination of two solid objects in simple vertical position.

Visualization concepts- Free hand sketching - Conversion of Isometric view to orthographic views. Perspective projection of simple solids (Qualitative only).

Introduction to CAD software (Not for Examinations)

Lecture: 45, Practical: 15, Total: 60

TEXT BOOKS:

- 1. Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Ltd, 13th Edition, 2015.
- 2. Jeyapoovan T., "Engineering Graphics with AUTOCAD", Vikas Publishing House Pvt., Ltd., 7th Edition, 2015.

REFERENCES:

- 1. Bhatt N.D., Panchal, V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd Edition, 2014.
- 2. Parthasarathy N.S. and Vela Murali, "Engineering Drawing", Oxford University Press, 1st Edition, Second Impression 2015.
- 3. Luzzader W..J. and Duff J.M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/105104148, "Engineering Graphics" Dr. Nihar Ranjan Patra , IIT Kanpur
- 2. http://cfd.annauniv.edu/webcontent.htm, "Engineering Graphics" Dr. Velamurali

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Draw the various conic sections and Engineering curves
- CO2 Sketch projections of lines and planes with vertical and inclined positions
- CO3 Draw the projections of solids kept in various positions.
- CO4 Sketch sectioned views of solids and development of surfaces.
- CO5 Draw the isometric and orthographic views from given pictorial views.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO 2	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO 3	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO 4	3	2	1	-	-	-	-	-	-	3	-	2	-	-
CO 5	3	2	1	-	-	-	-	-	-	3	-	2	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

22ECT11

SEMICONDUCTOR DEVICES (Common to ECE and Medical Electronics)

Pre-requisites : Nil

Preamble

The invention of solid state diodes and transistors has revolutionized the world. All the developments in the applications of electronics started with these. The fundamental components spawned into a range of signal and power devices. An engineer has to understand these devices which the building blocks of the circuits and systems.

UNIT 1 PN JUNCTION DIODE

Construction, Theory and operation of PN junction diode – VI Characteristics – current equation – Diode resistances and capacitances – Ratings – Applications - Zener diode and its characteristics – voltage regulation using zener diodes.

UNIT 2 BJT TRANSISTOR

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics.

UNIT 3 FET AND MOSFET

Construction, Operation, Characteristics and Application of JFET - JFET Parameters -JFET as VVR. Construction, Operation, Characteristics and Application of MOSFETs - EMOSFET and DMOSFET.

UNIT 4 SPECIAL PURPOSE DIODES

Construction, Operation, Characteristics and Application of Tunnel diode, Varactor diode, LED, Laser diode, Photodiode, Gunn diode, Schottky Diode.

UNIT 5 POWER DEVICES AND DIODE APPLICATIONS

Construction, Operation, Characteristics and Application of SCR, DIAC, TRIAC-IGBT. Operation and Analysis of Rectifiers: Half-Wave and Full-Wave (both centre-tapped and bridge types) Rectifiers with capacitor filters, Android app based circuit simulation.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Salivahanan S & Sureshkumar N, "Electronic Devices and Circuits", McGraw Hill, Fourth Edition, 2017.
- 2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education / PHI, 2013.

REFERENCES:

- 1. Dr. K.R. Valluvan, Prof. M. Vijayan, "Fundamentals of Semiconductor Devices", Charulatha Publications, 2018.
- 2. J. Millman, C Chalkias &SatyabrataJit, "Electronic Devices & Circuits", Tata McGraw Hill, 3rd Edition, 2010.
- 3. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 2004.

e-Resources:

- 1. https://nptel.ac.in/courses/108108122, Fundamentals of semiconductor devices, Prof. Digbijoy N. Nath, IISc Bangalore.
- 2. https://nptel.ac.in/courses/117103063, Basic Electronics, Prof. Chitralekha Mahanta, IIT Guwahati.

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Analyze the characteristics of PN junction diode and Zener diode under forward bias and reverse bias condition.
- CO2 Analyze the input and output characteristics of CB, CE and CC configurations of BJT.
- CO3 Discuss the Construction, Operation, Characteristics and Application of JFET and MOSFETs.
- CO4 Discuss the Construction, Operation, Characteristics and Application of Tunnel diode, Varactor diode, LED, Laser diode, Photodiode, Gunn diode, Schottky Diode.
- CO5 Analyze the characteristics of SCR, DIAC and TRIAC.

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	1	1	1	1	-	-	1	1	1	-	-
CO 2	3	1	1	1	1	1	1	-	-	1	1	1	-	-
CO 3	3	1	1	1	1	1	1	-	-	1	1	1	-	-
CO 4	3	1	1	1	1	1	1	-	-	1	1	1	-	-
CO 5	3	1	1	1	1	1	1	-	-	1	1	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

HERITAGE OF TAMILS/ தமிழர்மரபு

(For the students admitted fromAY2023- 24 onwards)

UNIT 1 LANGUAGE AND LITERATURE

22HST11

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT 2 HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT 3 FOLK AND MARTIAL ARTS

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT 4 THINAI CONCEPT OF TAMILS

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT 5 CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு – மக்களும்பண்பாடும் – கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

2. கணானாத்தயாய – முலைவைர் இல். சுந்தரய். (வகடன் பாரசுரய). 2. சீப்பட – வைகை சுடிர்சுதையில் சுந்த சால சுசுசு சுசுசியல் (சொல்

3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

VCET, B.E-MD, R2022, Curriculum and Syllabus

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12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – ReferenceBook. 22PHL11 PHYSICS AND CHEMISTRY LABORATORY I L T P C

(Common to all the branches -1^{st} Semester) $0 \quad 0 \quad 2 \quad 1$

Pre-requisites : HSC Physics and Chemistry

Preamble

This course aims to impart knowledge in the determination of the physical parameters such as wavelength of laser and mercury spectrum, Numerical aperture and acceptance angle of an optical fiber, velocity of ultrasonic waves and thermal conductivity of bad conductor and additionally necessitate the practical skills in determination of rate of corrosion in mild steel, water quality parameters and amount of iron in the given sample.

PHYSICS LABORATORY I LIST OF EXPERIMENTS

- 1. Determination of Optical property of Laser and Particle size of Lycopodium powder.
- 2. Determination of Numerical aperture and acceptance angle of an optical fiber.
- 3. Determination of velocity of ultrasonic waves- Ultrasonic Interferometer.
- 4. Determination of wavelength of mercury spectrum- Spectrometer grating.
- 5. Determination of Thermal conductivity of Bad conductor.

CHEMISTRY LABORATORY I LIST OF EXPERIMENTS

- 1. Determination of alkalinity in water sample
- 2. Determination of Calcium and Magnesium hardness in water by EDTA method.
- 3. Determination of rate of corrosion in Mild steel by weight loss method.
- 4. Determination of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).
- 5. Determination of iron content of the given solution using a potentiometer

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Experiment and determine the optical property of light sources using Laser, Spectrometer.
- CO2 Experiment and determine the velocity of ultrasonic waves through water medium using Ultrasonic Interferometer and acceptance angle of optical fiber.
- CO3 Experiment and determine the thermal conductivity of a given bad conductor using Lee's disc method.
- CO4 Experiment and estimate type and amount of alkalinity, calcium and magnesium hardness in water sample using titrimetry.
- CO5 Experiment and determine the rate of corrosion in mild steel by weight loss method.
- CO6 Experiment and determine the amount of iron content present in the given sample using potentiometer and spectrophotometer.

Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO2	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO3	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO4	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO5	2	1	-	3	-	1	1	-	1	1	1	1	-	-
1: Slight (Low) 2: Moderate (Medium)							•	3:	Substa	"-" No correlation				

WORKSHOP PRACTICES LABORATORY 22MEL11 L Т Р С

Pre-requisites: Nil

Preamble

Workshop practices give hands-on training practice to Engineering students. This course includes carpentry, plumbing, welding, sheet metal forming and welding exercises. Also, this course will inculcate in the students the habit of selecting right tools, planning the job and its execution

GROUP A **CIVIL**

Plumbing Works:

- Study of plumbing tools, pipeline joints, its location, functions and safety aspects.
- 1. a. Distribution of water from sump to overhead tank and return to home tap with bye pass connection.
 - b. Distribution of water in mixed pipes.

Carpentry using Power Tools only:

Study of the carpentry tools, joints and processes in roofs, doors, windows and furniture and safety precautions.

Hands-on-exercise:

- a. Tee Lap joint
- b. Dove tail joint

MECHANICAL

Welding:

- 1. Arc welding Lap joint
- 2. Arc welding Tee joint

Basic Machining:

- 3. Simple Turning and Facing
- 4. Drilling and Tapping

Sheet Metal Work- Forming & Bending:

5. Model making - Tray / Funnel

Study Experiments:

- (a) Study of centrifugal pump
- (b) Study of air conditioner

Demonstration:

• Gas welding practice

GROUP B

ELECTRICAL

- 1. Residential house wiring using switches, fuse, indicator and lamps.
- 2. Fluorescent lamp wiring.
- 3. Staircase wiring.
- 4. Reading of voltage, current, power, energy and other parameters with 1 phase digital energy meter.
- 5. Measurement of earth resistance.

ELECTRONICS

- 1. Identification and Study of Electronic components and equipments Resistors, capacitors, inductors, colour coding and measurement.
- 2. Measurement of AC signal parameters (peak-peak, RMS value, period, frequency) using CRO.
- 3. Verification of the truth tables of logic gates: AND, OR, XOR and NOT.
- 4. Construction of Half Wave and Full Wave Rectifiers and study their output waveforms.
- 5. Soldering practice Using general purpose PCB.

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Lecture :0, Tutorial: 0, Practical: 45 Total : 45

REFERENCES:

1. Manual prepared by the faculty of Mechanical Engineering Department, VCET.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Fabricate various joints by carpentry and to prepare plumbing line assemblies.
- CO2 Fabricate various joints through arc welding and gas welding processes.
- CO3 Perform metal forming and basic machining operations.
- CO4 Construct various types of domestic wiring and measure the various electrical parameters.
- CO5 Develop and test circuits with active elements and verify truth table of logic gates.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	3	-	-	2	2	-	1	-	-
CO 2	3	2	1	1	-	3	-	-	2	2	-	1	-	-
CO 3	3	2	1	1	-	3	-	-	2	2	-	1	-	-
CO 4	3	2	1	1	-	3	-	-	2	2	-	1	-	-
CO 5	3	2	1	1	-	3	-	-	2	2	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

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6 Reasons for Diseases: Natural Reasons (Hereditary, Planetary Position, Natural Calamities and Climatic changes)

6 Classification of Mind Waves – Beta, Alpha, Theeta, Delta – Agna Meditation – Benefits. Shanthi Mediation - Benefits. Thuriya Meditation - Benefits. Blessing and its Benefits: Auto Suggestion -

6 Individual Virtues: Self Control - Self Confidence - Speaking Truth - Contentment - Humility - Mind

Contentment - Tolerance - Charity - Chastity - Parity - Forgiveness. Five important Benefits of Meditation: Perspicacity - Magnanimity - Adaptability - Receptivity - Creativity. (Enhancing memory) (Effective

Total: 30 PERIODS

TEXT BOOKS:

22MCT02

Preamble

Benefits

constituents

Pre-requisites : Nil

knowledge on social virtues and morals.

UNIT 1 PHYSICAL HEALTH

UNIT 3 Wellness Of Mind

UNIT 4 VIRTUES

UNIT 5 MORALS

Examination Preparation)

Management.

UNIT 2 STRENGTHENING LIFE FORCES

Blessing the family and others – Blessings the World – Divine Protection.

- Artificial Reasons (Food, Thought, Deed).

"Yoga for Youth Empowerment" compiled by Vethathiri Maharishi Institute for Spiritual and Institutional 1. Education, Aliyar, Pollachi, 1st Edition 2016.

UNIVERSAL HUMAN VALUES

SKY - Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for Youth Empowerment - Simplified Physical Exercises: Explanation - Hand, Leg, Breathing and Eye exercises -Kapalabathi, Makarasanam, Massaging, Acupressure and Relaxation practices -Yogasanas- Explanation -

Biomagnetism – Mind. Maintaining Youthfulness – Postponing Aging – Transformation of Food into seven Body

Control. Tolerance - Adjustment - Sacrifice - Forgiveness. Cleanliness (Body, Dress, Surrounding)-External, Mental, Inner Cleanliness. Societal Virtues : Ahimsa – Services, Patriotism – Equality,

Importance of introspection: I and Mine (Ego, Possessiveness), Six Temperaments: Greed - Anger - Miserliness - Immoral Sexual Passion - Inferior Superior complex - Vengeance. Maneuvering the Six Temperaments:

"Yoga for Human Excellence", compiled by Vethathiri Maharishi Institute for Spiritual and Institutional 2. Education, Aliyar, Pollachi 1st Edition 2009.

e-Resources:

www.online.vethathiri.edu.in "online in (Virtual) Programme on Yoga and Human Excellence". 1.

Page 36

Philosophy of Kayakalpa: Physical Body -Life Force -

Respecting the parents and elders - Caring for them - Respecting Teachers. Punctuality - Time
Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Demonstrate the knowledge on physical health
- CO2 Discuss the factors for strengthening life force
- $CO3 \quad Classify \ mind \ waves \ and \ explain \ the \ benefits \ of \ meditation$
- CO4 Explain individual and social virtues
- CO5 Identify and explain the importance of morals.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	3	-	2	-	-	-	-	-	-
CO 3	-	-	-	-	-	3	-	2	-	-	-	-	-	-
CO 4	-	-	-	-	-	3	-	2	2	-	-	-	-	-
CO 5	-	-	-	-	-	3	-	-	2	-	-	-	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Preamble:

22ENT21

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

PROFESSIONAL ENGLISH

(Common to all B.E./B. Tech Programmes)

(Students admitted during 2023- 24 onwards)

UNIT 1 **ANALYTICAL READING**

Listening: Listening to Anecdotes - Stories - Event Narration - Documentaries and Interviews with Celebrities - Advertisements - Listening and Gap Filling Exercises Speaking: Conversation Skills -Initiating - Turn Taking - Closing - Explaining how something works - Persuasive Speech Techniques Reading: Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning Writing: Professional E-mails – E-mail Etiquette – Compare and Contrast Essays Grammar & Vocabulary: Prepositional Phrases – Same Word used as Different Parts of Speech.

UNIT 2 SUMMARISING

Listening: Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology – Listening Technical Information from Podcasts Speaking: Summarizing - Oral Reporting – Narrating Personal Experiences - Events - Interviewing a Celebrity Reading: Reading Scientific and Technical Articles - Texts Writing: Lab Reports - Summary Writing. Grammar & Vocabulary: Impersonal Passive Voice - Purpose Expressions.

DESCRIBING VISUAL MATERIALS UNIT 3

Listening: Listening to the Panel Discussion Speaking: Speaking at Formal Situations - Mini Presentation and Making Recommendations Reading: Reading Journal Articles - Speed Reading - Interpretation of Graphics - Flow Chart - Bar Chart Writing: Data Commentaries - Describing Visual Materials -Mechanics of Writing - Writing Complaints to Editorial Columns Grammar & Vocabulary: Subject-Verb Agreement - Pronouns - Relative Pronouns - Numerical Adjectives. 9

WRITING E-MAILS AND JOB APPLICATION LETTERS UNIT 4

Listening: Listening to Model Interviews Speaking: Speaking at Interviews - Role Play Practice Reading: Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) Writing: Filling up the Job Application - Cover Letter - Résumé Preparation - Internship Application Grammar & Vocabulary: 'If' Conditionals – Infinitives – Gerunds - Compound Nouns.

REPORT WRITING UNIT 5

Listening: Viewing a Model Group Discussion Speaking: Participating in a Group Talk -

Reading: Cause and Effect Essays - Business Letters Writing: Types of Reports - Report Format -Industrial Accident Report - Industrial Visit Report - Feasibility Report - Designing and Reporting Surveys – Writing Discursive Essays Grammar & Vocabulary: Reported Speech – Idioms and Phrases.

TOTAL: 45 PERIODS

TEXT BOOK:

'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 1. .2019.

REFERENCES:

- Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for 1. International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.
- 2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.
- 3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.
- e. **RESOURCES** :

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1. <u>www.eslgold.com</u>

2. <u>www.usingenglish.com</u>

- Course Outcomes: Upon completion of the course, students will be able to:
- **CO1** Read for gathering and understanding information using narrative techniques.
- CO2 Develop and demonstrate listening skills for academic and professional purposes.
- CO3 Apply apt vocabulary and construct grammatically correct sentences in professional situations.
- **CO4** Face interviews with communicative competence and confidence with a good knowledge of career skills.
- CO5 Enhance writing skills for essays and for preparing reports.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 3	-	1	-	-	1	3	-	-	2	3	-	1	-	-
CO 4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 5	-	-	-	-	1	1	-	-	2	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MAT21 CALCULUS AND COMPLEX ANALYSIS L Т 3 1

(Common to B.E - BM, EC, EE and MD Programmes)

Pre-requisites : Matrices and Differential Equations

Preamble

Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals. Complex Integration approach is very useful to evaluate many improper integrals of a real variable.

UNIT 1 INTEGRAL CALCULUS

Double and Triple Integrals in Cartesian coordinates - Evaluation of Double Integrals by Change of order of Integration – Applications of Multiple Integrals to find Area and Volume

UNIT 2 DIFFERENTIATION OF VECTORS

Del Operator - Del applied to scalar point function: Gradient and its applications to find unit normal vector, Directional derivative and Angle between two surfaces - Del applied to vector point function: Divergence, Curl and their applications to find Irrotational and Solenoidal vector fields - Vector operator identities (Statement only) - Simple Problems.

UNIT 3 INTEGRATION OF VECTORS

Line, Surface and Volume integrals - Vector Integral Theorems (without proof): Green's theorem in a plane - Gauss Divergence Theorem - Stoke's theorem - Simple applications involving squares, rectangles, cubes and rectangular parallelepipeds.

UNIT 4 ANALYTIC FUNCTIONS

Functions of a complex variable – Limit and continuity of f(z) – Derivative of f(z) – Cauchy-Riemann equations – Analytic functions – Harmonic and orthogonal properties of analytic function – Construction of analytic functions by Milne's method – Conformal mapping -Translation w=z+k, Magnification and Rotation w=kz, Inversion and Reflection w=1/z and bilinear transformation.

UNIT 5 COMPLEX INTEGRATION

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proof) -Power series expansions: Taylor's series and Laurent's series - Singularities - Residues-Cauchy Residue theorem (excluding proof) – Evaluation of real definite integrals as contour integrals (around unit circle, semi-circle excluding poles on the real axis).

TEXT BOOKS:

- 1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
- 2. George B, Thomas, Joel Hass, Christopher Heil and Maurice D. Weir "Thomas' Calculus". Pearson 14 th Edition, 2018

REFERENCES:

- N.P.Bali, Manish Goyal, "Engineering Mathematics", Lakshmi Publications (PVT) Ltd, 4 th 1. edition,2014.
- 2. Grewal B.S., "Higher Engineering Mathematics" 43rd Edition, Khanna Publishers, New Delhi, 2014.

e-Resources:

https://nptel.ac.in/courses/111105122 "Integral and Vector Calculus", Prof. Hari Shankar Mahato, 1.

Lecture: 45, Tutorial: 15, Total: 60

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Department of Mathematicss, IIT Kharagpur.

2. <u>https://nptel.ac.in/courses/111103070</u> "Complex Analysis" Prof. P. A. S. Sree Krishna, Department of Mathematics, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Apply multiple integrals to determine area and volume in Cartesian coordinates.
- CO2 Apply the concepts of vector calculus in vector differentiation.
- CO3 Apply the concepts of vector calculus in vector integration.
- CO4 Represent the analytic functions using conformal mapping and bilinear transformation.
- CO5 Classify the singularities and evaluate complex integration.

COs/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 4	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	2	2	-	-	-	-	-	-	-	1	-	-
1: Slight (Lo	w)	2: I	Aodera	te (M	edium))	3: Su	bstanti	al (Hi	gh)	"-" N	lo cor	relation	!

Mapping of COs with POs and PSOs

REFERENCES:

1. W.J. Meredith and J.B. Massey — Fundamental Physics of Radiology Varghese Publishing house.

VCET, B.E-MD, R2022, Curriculum and Syllabus

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2.

TEXT BOOKS:

1.4.5

(Unit 2,3,4)

UNIT 5 PRINCIPLES AND APPLICATIONS OF SOUND IN MEDICINE

Physics of sound, Normal sound levels, Measurement of hearing, ultrasound fundamentals, Generation of ultrasound (Ultrasound Transducer), Interaction of Ultrasound with matter- Cavitations, Reflection, Transmission, Scanning methods, Artifacts, Ultrasound- Doppler effect, Clinical Applications.

B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford, D.R. Hose, -Medical Physics and

Biomedical Engineering, Institute of physics publishing, Bristol and Philadelphia, 1999. (Unit

Gopal B. Saha — Physics and Radiobiology of Nuclear Medicine Third edition Springer, 2006.

Lecture: 45, Tutorial: 0, Total: 45

Page 42

Preamble

22BMT21

Medical Physics is an applied branch of Physics concerned with the application of the radiation concepts and methods of Physics in Medical science. This course accentuates the principle, effects and clinical applications of ionizing, non-ionizing electromagnetic radiation. This also enunciates the fundamentals of acoustic waves and their interaction with human tissues.

MEDICAL PHYSICS

(Common to B.E- BM and MD Programmes)

LOW ENERGY ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL UNIT 1 **APPLICATION**

Physics of light, Intensity of light, limits of vision and color vision an overview, Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Tissue as a leaky dielectric-Low Frequency Effects- Higher frequency effects, Ultraviolet radiation, Thermography- Application.

PRINCIPLES OF RADIOACTIVE NUCLIDES UNIT 2

Radioactive Decay - Spontaneous Emission - Isometric Transition - Gamma ray emission, alpha, beta, Positron decay, electron capture, Kinetics of Radioactive decay – Decay equation, Half life, Mean life, Effective half life. Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Production of radionuclides - Cyclotron produced Radionuclide- Reactor produced Radionuclide-fission and neutron capture reaction, radionuclide Generator-Technetium generator.

UNIT 3 INTERACTION OF RADIATION WITH MATTER

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 4 RADIATION DOSE AND ITS EFFECTS

Dose and Exposure measurements - Units (SI), Inverse square law, Maximum permissible exposure, relationship between the dosimetric quantities, Radiation biology - effects of radiation, direct and indirect actions of radiation, Cell survival curves, concept of LD 50, Stochastic and Non-stochastic effects, Radiation Syndrome.

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- 2. Steve Webb, The Physics of Medical Imaging, Taylor & Francis, Newyork, 2010
- 3. R.S. Khandpur, —Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2003.

e-Resources:

- 1. <u>http://www.nptel.ac.in/courses/115102017/</u>, "Nuclear science and Engineering", Dr. Santanu Gosh, Department of Physics, IIT, Delhi.
- 2. <u>http://www.uthgsbsmedphys.org/GS02-0093/</u>," Introduction to Medical Physics I", Dr George Starkschall, The University of Texas at Houston.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Interpret the properties of electromagnetic radiations and its effect on human.
- CO2 Describe the principles and production of radioactive nuclides.
- CO3 Explain the interaction of radiation with matter.
- CO4 Identify and explain the radiation quantities and its effects
- CO5 Demonstrate the knowledge on the properties of sound and its application in medicine.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	3	2	-	2	2	-	-	-	-	2	-	-
CO 2	2	3	3	2	-	2	2	-	-	-	-	2	-	-
CO 3	2	3	3	2	-	2	2	-	-	-	-	2	-	-
CO 4	2	3	3	2	2	2	2	-	-	-	-	2	-	-
CO 5	2	3	3	2	2	2	2	-	-	-	-	2	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

VCET, B.E-MD, R2022, Curriculum and Syllabus

TEXT BOOKS:

- Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University 1. Press. 2017.
- Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, 2. O'Reilly Publishers, 2016.

PYTHON PROGRAMMING (Common to all B.E /B. Tech Programmes)

Pre-requisites : Nil

Preamble

22CST11

Python is easy to use, powerful, and versatile, making it a great choice for beginners and experts alike. Python's readability makes it a great first programming language — it allows you to think like a programmer and not waste time understanding the mysterious syntax that other programming languages can require. The syntax in Python helps the programmers to do coding in fewer steps. Python is widely used in bigger organizations because of its multiple programming paradigms.

UNIT 1 COMPUTING FUNDAMENTALS

Fundamentals of Computing - Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT 2 INTRODUCTION TO PYTHON

Python interpreter, data types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT 3 CONTROL FLOW, FUNCTIONS, STRINGS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (ifelif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT 4 LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT 5 FILES, MODULES AND PACKAGES

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages, Introduction to Pygame tool; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

Total: 45 Periods

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Page 44

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REFERENCES:

- 1. E Balagurusamy," Problem Solving and Python Programming", McGraw Hill Education, 2018
- 2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1stEdition, Notion Press, 2021.

e-Resources:

- 1. <u>https://swayam.gov.in/course/4178-spoken-tutorial-python-english</u>, "Introduction to Python", Prof. Prabhu Ramachandran, IIT Bombay.
- 2. https://onlinecourses.nptel.ac.in/noc18_cs21, "Programming, Data Structures and Algorithms Using Python", Prof.Madhavan Mukund, IIT-Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Use the basics of algorithmic problem solving techniques (pseudo code, flow chart, language basics) for a given problem.
- CO2 Apply suitable python conditional and looping statements to solve a given problem.
- CO3 Define Python functions and use function calls to solve problems.
- CO4 Use Python data structures (lists, tuples, and dictionaries) to represent complex data.
- CO5 Create python packages, modules and files for a given scenario.

Cos/POs	РО 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO 2	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO 3	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO 4	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO 5	3	2	2	2	1	-	-	-	-	-	1	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22ECT22 ELECTRIC CIRCUITS AND MACHINES L T P C

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Preamble

Electrical networks, systems and devices are the basic building blocks for today's most complex electrical and electronic systems. It is essential to understand these fundamentals to gain knowledge on solving circuits using network theorems and to obtain the transient responses of AC and DC circuits. As medical electronics engineer has to work with many electrical systems, it is relevant to know the functional aspect of machines, wiring and other electrical appliances.

UNIT 1 DC CIRCUITS

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law – Kirchhoff's Laws – Independent and Dependent Sources – Simple Problems in Nodal Analysis and Mesh Analysis

UNIT 2 NETWORK THEOREMS FOR DC CIRCUITS

Network Reduction: Voltage and Current Division Rule – Source Transformation: Star-Delta Conversion – Thevenin's and Norton's Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem – Duality in Circuits

UNIT 3 AC CIRCUITS

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous Power, Real Power, Reactive Power, Apparent Power, and Power Factor – AC passing through pure R, L and C – Series and Parallel Resonances – Quality Factor and Bandwidth – Self and Mutual Inductances – Coefficient of Coupling – Series and Parallel connection of coupled Coils – Simple Problems

UNIT 4 DC MACHINES, TRANSFORMERS AND INDUCTION MOTORS

DC Machines: Construction and Principle – EMF Equation of DC Generator – Shunt Generator – DC Motor – Speed and Torque Characteristics of DC Series and Shunt Motors – Back EMF – Applications of Series and Shunt Motors. Transformers: Single Phase Transformer – Types: Step Down, Step Up, Auto and Isolation Transformers – Construction and Operation of Single Phase Squirrel Cage Induction Motors – Construction and Operation of Stepper and BLDC Motors

UNIT 5 ELECTRICAL WIRING AND APPLIANCES

Domestic wiring: Components of Distribution Board – Typical Domestic Distribution – Stair Case Wiring – Types of Wires and their Rating – Earthing – Fuse Ratings – MCB – ELCB – Online UPS – Rating of UPS and Battery. Fluorescent and LED Lamps – Qualitative Approach of Electrical Appliances - Ceiling fan, Mixie - Compressor, Centrifugal and Submersible Pumps

Total: 45 Periods

TEXT BOOKS:

- 1. Kothari D.P. and Nagrath I.J., "Basic Electrical Engineering", McGraw Hill Education, Fourth Edition, 2019.
- 2. Sudhakar A and Shyammohan SP, "Circuits and Networks", McGraw Hill, Fifth Edition, 2015.
- 3. Bimbhra P. S., "Electrical Machinery", Khanna Publishing, First Edition, 2021.

REFERENCES:

- 1. Gengsheng Lawrence Zeng and Megan Zeng, "Electric Circuits", Springer International Publishing, 2021.
- 2. Sahdev S. K., "Electrical Machines", Cambridge University Press, 2018.

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e-Resources:

- 1. https://nptel.ac.in/courses/108105053, "Basic Electrical Technology", Prof. G.D. Roy and Prof. T.K. Bhattacharya, IIT Kharagpur.
- 2. https://nptel.ac.in/courses/108102146, "Electrical Machines", Prof. G. Bhuvaneswari, IIT Delhi

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Analyze the various DC circuits and find the circuit parameters.
- CO2 Solve for network parameters using various circuit theorems.
- CO3 Demonstrate the knowledge on transient responses, resonance and coupled circuits.
- CO4 Illustrate the construction and working principle of transformers, DC machines and induction motors
- CO5 Explain the knowledge of the practices of wiring and operation of appliances.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	2	-	-	-	-	-	-	-	2	2	-
CO 2	3	2	1	2	-	-	-	-	-	-	-	2	2	-
CO 3	2	2	1	2	-	-	-	-	-	-	-	2	2	-
CO 4	2	2	1	2	-	-	-	-	-	-	-	2	2	-
CO 5	2	2	1	2	-	-	-	-	-	-	-	2	2	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

UNIT 1 LANGUAGE AND LITERATURE

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT 2 HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT 3 FOLK AND MARTIAL ARTS

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT 4 THINAI CONCEPT OF TAMILS

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT 5 CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு – மக்களும்பண்பாடும் – கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).

3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text

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22HST21 TAMILS AND TECHNOLOGY/ தமிழரும்தொழில்நுட்பமும்

UNIT 1 WEAVING AND CERAMIC TECHNOLOGY

(For the students admitted from AY 2023-24 onwards)

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.	
UNIT 2 DESIGN AND CONSTRUCTION TECHNOLOGY Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	3
UNIT 3 MANUFACTURING TECHNOLOGY Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coin as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.	3 15
UNIT 4 AGRICULTURE AND IRRIGATION TECHNOLOGY Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	3
UNIT 5 SCIENTIFIC TAMIL & TAMIL COMPUTING Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	3 f
Total :	15
TEXT-CUM-REFERENCE BOOKS 1. தமிழகவரலாறு – மக்களும்பண்பாடும் – கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்) 2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்). 3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)	
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு) 5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) 6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.	
 7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). 8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) 	
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,	

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Tamil Nadu)

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10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22PHL21PHYSICS AND CHEMISTRY LABORATORY IILTPC(Common to all B.E/B.Tech Programmes)0021

Preamble

This course aims to impart knowledge in the determination of the physical parameters such as young's modulus, band gap, Co-efficient of viscosity, thickness of thin wire and Rigidity modulus of wire. This course also aims to impart the significance and estimation of DO and Cl⁻ content in water sample by titrimetric method. Amount of Na⁺, Ba²⁺and acid with electroanalytical techniques such as flame photometry, conductometry and pH meter in the aqueous solutions has been quantitatively analyzed.

PHYSICS LABORATORY II LIST OF EXPERIMENTS

- 1. Determination of Young's modulus by Uniform bending method.
- 2. Determination of bandgap of semiconductors.
- 3. Determination of co-efficient of viscosity by Poiseuille's method.
- 4. Determination of thickness of thin wire by Air wedge method.
- 5. Determination of rigidity modulus-torsion pendulum.

CHEMISTRY LABORATORY II LIST OF EXPERIMENTS

- 1. Determination of Dissolved Oxygen content of waste water sample by Winkler's method.
- 2. Determination of chloride content of wastewater sample by Argentometric method.
- 3. Estimation of dissolved metal ions present in wastewater using flame photometer.
- 4. Conductometric precipitation titration of BaCl₂ vs Na₂SO₄ using conductivity meter.
- 5. Determination of acid strength in waste water using pH meter.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Experiment and determine the physical characteristics of given solid materials using Young's modulus-Uniform bending method, Air wedge and Torsion Pendulum
- CO2 Experiment and determine the band gap energy of a given semiconducting material using Zener diode.
- CO3 Experiment and determine the physical characteristics of a given liquid using Poiseuille's method.
- CO4 Experiment and estimate the amount of dissolved oxygen by Winkler's method and Chloride content by Mohr's method.
- CO5 Analyse the concentration of metal ions and acid present in the wastewater with the aid of Flame photmeter, Conductivity meter and pH meter.

COs\PO s	P 0 1	P 0 2	P 0 3	P 0 4	P 0 5	P 0 6	P 0 7	P 0 8	P 0 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO2	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO3	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO4	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO5	2	1	-	3	-	1	1	-	1	1	1	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High)

22ECL22ELECTRIC CIRCUITS AND ELECTRON DEVICES
LABORATORYL T P C
0 0 2 1

Preamble:

The course is used to assist the students in obtaining a better understanding of the operation of electronic circuits and devices and to provide experience in analyzing network theorems.

LIST OF EXPERIMENTS

- 1. Verification of KVL and KCL
- 2. Verification of Thevenin's and Norton's theorems.
- 3. Verification of Maximum Power Transfer theorem.
- 4. Verification of Reciprocity Theorem.
- 5. Frequency response of RLC series and parallel resonance circuits.
- 6. Characteristics of PN and Zener diode.
- 7. Characteristics of CE, CB configurations.
- 8. Characteristics of JFET.
- 9. Half wave and Full wave rectifier with capacitor filter.
- 10. Voltage regulation using Zener diode.
- 11. Study of characteristics of photo diodes
- 12. Study of characteristics of SCR

Course Outcomes: Upon completion of the course, students will be able to:

Experiment and test the given electric circuit using Kirchhoff's laws and obtain the mesh

- 1. current & node voltage and obtain the load current for the given circuit using Thevenin's, Norton's and Reciprocity theorems.
- 2. Construct and test RLC series and parallel circuits to compute the resonant frequency and bandwidth by plotting the frequency response.
- 3. Experiment and determine the VI characteristics of given PN junction diode, Zener diode, Photo diode and Silicon Controlled Rectifier.
- 4. Experiment and determine the Input & output characteristics of BJT and drain & transfer characteristics of JFET.

Experiment and test half wave and full wave rectifier circuit using PN Junction diode and obtain the ripple factor, rectifier efficiency and experiment and test voltage regulation characteristics

5. using Zener diode voltage regulator circuit and determine the regulation characteristics.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	3	-	-	-	-	1	-	-	1	2	2
CO2	2	1	-	3	-	-	-	-	1	-	-	1	2	2
CO3	2	2	-	3	-	-	-	-	1	-	1	1	2	2
CO4	2	2	-	3	-	-	-	-	1	-	1	1	2	2
CO5	2	2	-	3	-	1	1	-	1	-	1	1	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

22CSL11

PYTHON PROGRAMMING LABORATORY (Common to all B.E/B.Tech Programmes)

L T P C 0 0 2 1

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

- Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute
- Electrical Current in Three Phase AC Circuit, etc.)Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points)
- 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
- 4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
- Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
- 6. Implementing programs using Functions.
 - (Factorial, largest number in a list, area of shape)
- 7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
- 8. Implementing programs using written modules and Python Standard Libraries Libraries (pandas, numpy. Matplotlib, scipy)
- 9. Implementing real-time/technical applications using File handling
- 10. Developing a game activity using Pygame like bouncing ball, car race

SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Design flowcharts using Raptor.
- 2. Develop programs using expressions and Control statements in Python.
- 3. Develop programs using functions, packages for a given problem..
- 4. Process compound data using Python data structures
- 5. Utilize Python packages in developing software applications.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO2	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO3	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO4	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO5	2	2	2	3	-	-	-	-	1	-	-	1	-	-

- 1: Slight (Low)
- 2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

22CSL11

PYTHON PROGRAMMING LABORATORY

L T P C 0 0 2 1

(Common to all B.E, B.Tech Programmes) ((For the students admitted from AY2024- 25 onwards)

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.

(Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

- 2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points)
- 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
- Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
- Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
- 6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
- 7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
- 8. Implementation of searching algorithms using linear and binary search technique.
- 9. Implementation of sorting algorithms using selection sort and insertion sort method.
- 10. Implementing programs using written modules and Python Standard Libraries Libraries (pandas, numpy. Matplotlib, scipy)
- 11. Implementing real-time/technical applications using File handling.
- 12. Developing a game activity using Pygame like bouncing ball, car race.

SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Design flowcharts using Raptor.
- CO2 Develop programs using expressions and Control statements in Python.
- CO3 Develop programs using functions, packages for a given problem..
- CO4 Process compound data using Python data structures
- CO5 Utilize Python packages in developing software applications.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO2	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO3	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO4	2	2	2	3	-	-	-	-	1	-	-	1	_	-
CO5	2	2	2	3	-	-	-	-	1	-	-	1	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

(RATIFIED SYLLABUS)

22MCT02	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	Т	Р	С
22IVIC 105	(Common to all B.E/B.Tech Programmes)	2	0	0	0

Preamble

The study of biodiversity reflects the level of national interest in natural resources and heritage, which is considered as an important part of a country's wealth. As India is one of the world's 12 giant diversity hubs, we need to focus on understanding, preserving and utilizing the biodiversity of our biological resources. Environmental protection is an important issue for today's society, as scientific research provides evidence of increased global warming, ozone depletion and increased pollution. Engineers need to learn the importance of green synthesis in the design, development and evaluation of structures, devices and systems to provide practical solutions to the problems caused by the pollution and depletion of natural resources.

UNIT NATURAL RESOURCES, ECOSYSTEM AND BIODIVERSITY

Forest Resources – use and over exploitation – Water Resources – use and over utilization – Dams – benefits and problems – Ecosystem – structure and function – Biodiversity – types – threats to biodiversity – Biodiversity conservation–In-situ and Ex-situ – Role of an individual in conservation of natural resources.

UNIT ENVIRONMENTAL POLLUTION

2

Definition – causes, effects and control measures – Air Pollution, Water Pollution, Soil Pollution – Solid waste – methods of disposal – sanitary landfill, incineration and composting – Environmental Impact Assessment and ISO 14000.

UNIT E-WASTE AND ITS MANAGEMENT

3

E-Waste – sources of e-waste – hazardous substances in e-waste – effects of e-waste on environment and human health – need for e-waste management – disposal treatment methods of e-waste – Global scenario of e-waste – e-waste in India- case studies.

UNIT SOCIAL ISSUES AND THE ENVIRONMENT

4

 $Social\ issues\ -\ Sustainable\ development\ -\ Water\ conservation\ -\ rain\ water\ harvesting.\ Disaster\ Management\ -\ floods,\ earthquake,\ cyclone\ and\ landslides.\ Role\ of\ IT\ in\ environment\ and\ human\ health.$

UNIT 5 GREEN CHEMISTRY

Green Chemistry – twelve principles of green chemistry – Importance of green synthesis – Green synthesis – dimethyl carbonate – Bio-catalysts – extraction of gold – Applications of green synthesis.

TOTAL : 30 PERIODS

6

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TEXT BOOKS:

- 1. Environmental Science, 5th Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, V. N. Kowshalya, Pearson India Education services Private Limited, 2020.
- 2. Environmental Science and Engineering, 2nd edition, Dr.T. Arun Luiz, V K publications, 2018.

REFERENCES:

- 1. Environmental Science and Engineering, 3rd reprint, Benny Joseph, McGraw Hill Education (India) Private Limited, New Delhi, 2015.
- 2. Engineering Chemistry, 1st Impression, K. Sesha Maheswaramma, Mridula Chugh, Pearson India Education Services Private Limited, 2016.
- 3. Introduction to Environmental Engineering and Science, 2nd edition, Gilbert M. Masters, Prentice Hall of India Private Limited, 2015.

e-Resources:

- 1. <u>https://www.digimat.in/nptel/courses/video/105105169/L01.html</u>, "Electronic waste management-issues and challenges"- Prof. Brajesh Kumar Dubey, Department of Civil Engineering, IIT Kharagpur.
- 2. <u>https://archive.nptel.ac.in/courses/105/103/105103205/</u>, "Municipal solid waste management"-Prof. Ajay Kalamdhad, Department of Civil Engineering, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Recognize the biodiversity threats, overexploitation of forest and overutilization of water to conserve biodiversity.
- CO2 Analyze sources, impacts, air and water pollution control measures and solid waste management
- to maintain a green environment.
- CO3 Identify the Environmental impacts of e-waste and its management.
- CO4 Explain human health, environment and disaster management through information technology.
- CO5 Apply the principles of green chemistry to green synthesis for a sustainable environment.

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO2	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO3	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO4	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO5	3	2	1	1	1	2	3	2	1	1	1	2	-	-
Mapping Average	3	2	1	1	1	2	3	2	1	1	1	2	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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Sample space – Events – axioms of probability – conditional probability – Baye's theorem – Random variables: Discrete and continuous random variables - Moments.

Discrete distributions: Binomial, Poisson and Geometric distributions - Continuous distributions:

TEXT BOOKS:

- Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, University 1. Press India (P) Ltd, Hyderabad (2015).
- Grewal, B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna publishers, Delhi (2016) 2.
- Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Edition 3. 2014.
- Walpole, S.C., Myers, R.H., Myers, S.L., and Ye.K., "Probability and Statistics for Engineerrs and 4. Statistics",9th Edition,Pearson Education India,2013.

REFERENCES:

- Ramana.B.V., "Higher Engineering Mathematics", First edition, Tata Mc-GrawHill Publishing 1. Company limited, New Delhi, 2016
- Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth edition, Wiley Dream Tech 2. India (P) Ltd. 2016
- 3. Johnson R.A., and Gupta.C.B., 'Miller and Freund's Probability and Statistics for Engineers," 8th Edition, Pearson Education India, 2015.
- 4. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002

e-Resources:

- https://archive.nptel.ac.in/courses/111/106/1111061111/ "Transform techniques for Engineers" 1. Dr. Srinivasa Rao Manam, Department of Mathematics, IIT Madras.
- http://nptel.ac.in/courses/117105085/7, "Probability and Random Variables", 2.

22MAT32 TRANSFORM TECHNIQUES AND PROBABILTY THEORY Т L

(Common to B.E. Electronics and Communication Engineering and 3 1 Medical Electronics Programmes in Third Semester)

Pre-requisites :

22MAT11-Matrices and Differential Equations, 22MAT21- Calculus and Complex analysis **Preamble**

This course aims to provide sufficient knowledge to engineering students in the specific mathematical techniques such as Fourier series, Fourier transforms and Z transforms. Probability theory is used extensively in the design of modern communication systems in order to understand the behavior of noise in the system.

UNIT 1 FOURIER SERIES

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

UNIT 2 FOURIER TRANSFORMS

Statement of Fourier integral theorem – Fourier transforms pair – Fourier sine and cosine transforms – Properties - Convolution theorem - Parseval's identity.

Z TRANSFORMS UNIT 3

Z-transforms - Elementary properties - Inverse Z-transform (using Partial Fraction and Residues) -Convolution theorem - Formation of difference equations - Solution of difference equations using Z-transform.

UNIT 4 PROBABILITY THEORY

UNIT 5 STANDARD DISTRIBUTIONS

Uniform, Exponential, Weibull and Normal distributions.

Lecture : 45; Tutorial : 15; Total : 60

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Prof. M. Chakraborty, Department of Electronics and Electrical Communication Engineering, Indian Institute of Technology, Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Compute the trigonometric form of the Fourier series for periodic waveforms satisfying the Dirichlet's conditions and using them to evaluate infinite series.
- CO2 Compute the Fourier transform of non-periodic waveforms using Fourier Transform properties.
- CO3 Solve the difference equations of first and second order using Z-transform techniques.
- CO4 Understand conditional probability and solve the problems of Baye's theorem. Compute the probability and moments of one dimensional random variables.
- CO5 Model and solve the real life problems using discrete and continuous distributions.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 4	3	3	1	1	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	1	1	-	-	-	-	-	-	-	1	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MDT31

Pre-requisites : Nil

Preamble

This course intends to give knowledge about the basics of biology to engineering students by emphasizing the role of biomolecules by providing basic information on specific metabolic diseases and disorders. This course also enables to Gain knowledge on the structural and functional aspects of living organisms and to understand the etiology and remedy in treating the pathological diseases.

BIOSCIENCES

UNIT 1 FUNDAMENTALS OF BIOCHEMISTRY

Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes

UNIT 2 CARBOHYDRATES, LIPIDS, PROTEIN

Classification of carbohydrates-Structure, physical and chemical properties of carbohydrates -Classification of lipids. Nomenclature of fatty acid - Structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Nucleic acid: Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA.

UNIT 3 CELL DEGENERATION, REPAIR AND NEOPLASIA

Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. Cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT 4 FLUID AND HEMODYNAMIC DERANGEMENTS

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Blood: Composition – Functions - Haemostasis – Blood groups and typing. Hematological disorders, Bleeding disorders, Leukaemias, Lymphomas Haemorrhage.

UNIT 5 FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY

Structure of Bacteria and Virus - Morphological features and structural organization of bacteria and virus - List of common bacterial, fungal and viral diseases of human beings. - Basics of Microscopes: Light microscope, Electron microscope (TEM & SEM). - Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury, Immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Rafi MD "Text book of biochemistry for Medical Student" Fourth Edition, Universities Press, Orient Blackswan Private Limited New Delhi 2021.
- 2. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of Diseases", Tenth Edition: South Asia Edition Elsevier India, 2020.
- 3. Ananthanarayanan & Panicker, "Microbiology" Orientblackswan, Tenth Edition, 2017

REFERENCES:

- 1. Prescott, Harley and Klein, "Microbiology", Tenth Edition, McGraw Hill, 2017
- 2. Dubey RC and Maheswari DK. "A Text Book of Microbiology" Chand & Company Ltd, 2007

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- 3. Underwood JCE: General and Systematic Pathology Churchill Livingstone, Third edition, 2000
- 4. Keith Wilson & John Walker, "Practical Biochemistry Principles & Techniques", Oxford University Press, 2009

e-Resources:

- 1. <u>https://archive.nptel.ac.in/courses/102/105/102105083/,Immunology</u>, Prof. Sudip Kumar Ghosh, Prof. Agneyo Ganguly, IIT Kharagpur
- 2. <u>https://archive.nptel.ac.in/courses/104/105/102105034/,Biochemistry</u>, Prof. Swagata Dasgupta , IIT Kharagpur

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the fundamentals of biochemistry
- CO2 Analyze structural and functional aspects of living organisms
- CO3 Explain the function of microscope
- CO4 Enumerate the hemostatsis and its disorders.
- CO5 Describe methods involved in treating the pathological diseases

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO 2	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO 3	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO 4	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO 5	3	2	1	1	-	-	-	1	-	1	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDT32

ANATOMY AND HUMAN PHYSIOLOGY

Pre-requisites : Nil

Preamble

This course provides knowledge in the organization, structures, and functions of the human body. Students will learn the terminology, anatomy and physiology, and pathology of each body system. The goal of this course is to instruct students about the functions, processes, and interrelationships of the many organs and systems involved in disease, as well as to provide them with typical standards of reference to utilize when diagnosing and treating deviations from the normal.

UNIT 1 BASIC ELEMENTS OF HUMAN BODY

Cell - Cell Structure and organelles - Functions of each component in the cell. Cell membrane transport across membrane - Action potential (Nernst, Goldman equation), Homeostasis. Tissue: Types, functions.

UNIT 2 SKELETAL AND MUSCULAR SYSTEM

Skeletal: Types of Bone and function - Physiology of Bone formation - Division of Skeleton - Types of joints and function – Types of cartilage and function. –Types of muscles – Structure and Properties of Skeletal Muscle- Changes during muscle contraction- Neuromuscular junction.

UNIT 3 CARDIOVASCULAR AND RESPIRATORY SYSTEM

Cardiovascular System: Structure - Conduction System of heart - Cardiac Cycle - Cardiac output. Blood Vessels - Structure and types - Blood pressure - Respiratory system: Parts of respiratory system -Respiratory physiology – Lung volumes and capacities – Gaseous exchange.

UNIT 4 DIGESTIVE AND EXCRETORY SYSTEMS

Structure and functions of gastrointestinal system - Secretory functions of the alimentary tract - digestion and absorption in the gastrointestinal tract. Structure of Nephron - mechanism of urine formation - skin and sweat gland - temperature regulation.

UNIT 5 NERVOUS AND SENSORY SYSTEM

Structure and function of nervous tissue - Brain and spinal cord - Functions of CNS - Nerve conduction and synapse – Reflex action– Somatic and Autonomic Nervous system. Physiology of Vision, Hearing. Integumentary System.

TEXT BOOKS:

- Elaine.N. Marieb, "Essential of Human Anatomy and Physiology", Ninth Edition, Pearson 1. Education, New Delhi, 2018.
- 2. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine" Third edition Springer, 2006. (Unit 2,3,4)
- K. Sembulingam, Prema Sembulingam, "Essentials of Medical Physiology" Jaypee Brothers 3. Medical Publishers (P) Ltd New Delhi, Seventh Edition ,2016

REFERENCES:

- Guyton & Hall, "Text book of Medical Physiology", 13th Edition, Saunders, 2015. 1.
- Ranganathan T S, "Text book of Human Anatomy", S.Chand& Co. Ltd., New Delhi, 2012 2.
- SaradaSubramanyam, K MadhavanKutty, Singh H D, "Textbook of Human Physiology", S. 3. Chand and Company Ltd, New Delhi, 2012.
- Victor W. Rodwell, David Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil, 4. "Harper's Illustrated Biochemistry", Thirty first Edition, McGraw-Hill Professional, 2018

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TOTAL : 45 PERIODS

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e-Resources:

- 1. <u>http://nptel.ac.in/courses/107103004/7</u>, "Human physical dimension concern", Prof.Mainak Das, IIT Kandpur.
- <u>http://nptel.ac.in/courses/122103039/14</u>, "Nervous System", Prof.Mainak Das, IIT Kandpur.
 https://nptel.ac.in/courses/102105034/17
 - , "Biochemistry", Prof. Swagatagupta, IIT Kandpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Identify and explain basic elements of human body
- CO2 Explain the functions of skeletal and muscular system
- CO3 Describe the structure, function of cardiovascular system and respiratory system
- CO4 Discuss the structure of digestive and excretory system.
- CO5 Describe the physiological process of Nervous and sensory system

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO 2	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO 3	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO 4	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO 5	3	2	1	1	-	-	-	1	-	1	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDT33

Pre-requisites : Nil

Preamble

22MDT32

The Course enables the students to assess the measuring instruments and the methods of measurement.

UNIT 1 SENSOR BASED MEASUREMENT SYSTEM

General Measuring System, Instrumentation – classification of instruments – Functional elements of an instrument, Static and Dynamic characteristics, Errors in measurement, Calibration of instruments, Standards and their classification, Sensor classification and materials for sensor.

UNIT 2 MEASUREMENTOFNON-ELECTRICALQUANTITIES

Strain gauges: gauge factor-Types of strain gauges- Biomedical applications, Transducer: Capacitive and Inductive transducer - Biomedical applications, Passive types: Thermistor - biomedical applications, Active type: Thermocouple - biomedical applications, Hall effect Transducers, Case Study: Sensors for Environmental monitoring.

UNIT 3 SIGNALCONDITIONING& SIGNAL ANALYSER

AC and DC Bridges–wheat stonebridge–Kelvin–kelvindoublebridge,Maxwell–Hay–Schering,Anderson's, Signal analyzer :Wave-Spectrum analyzer.

UNIT 4 PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS

Phototubes - Photo multiplier tube(PMT) - Scintillation counter - Photo conductive cells - Photo diodes-Photo voltaic cell - Phototransistor - Comparison of photoelectric transducers, Piezoelectric transducersmodes of operation of piezoelectric crystals- uses of piezoelectric materials and transducers, Case study: Optical sensors for diagnosis.

UNIT 5 DISPLAY AND RECORDING DEVICES

Digital voltmeter, Multimeter, CRO and DSO, Graphic recorders-stripchart, X-Y recorder, Magnetic tape recorder, photographic recorder, inkjet recorder, Thermal array recorder, Development in Sensor Technology-Smart Sensors, Biosensors.

TEXT BOOKS:

- 1. A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation", Dhanpat Rai & Co, New Delhi, 2017.
- 2. John G. Webster, "Medical Instrumentation Application and Design", Wiley India Pvt Ltd, New Delhi, 2020.

REFERENCES:

- 1. Albert D.Helfrick, William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2016.
- 2. BanshiDhar Gupta, Anand Mohan Shrivastav and Sruthi Prasood Usha, "Optical Sensors for Biomedical Diagnostics and Environmental Monitoring", CRC Press, New York, 2018.

e-Resources:

- 1. http://nptel.ac.in/courses/112103174/3, Sensors and Transducers by Prof. Alok Barua Department of Electrical Engineering, IIT Kharagpur.
- 2. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html, Piezoelectric sensors

TOTAL : 45 PERIODS

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byProf. Alok Barua, Department of Electrical Engineering, IIT - Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Analyze the purpose and methods of measurements and classification of transducer.
- CO2 Identify the type of transducers and explain their need in biomedical applications.
- CO3 Assess the principles of signal conditioning and signal analyzer.
- CO4 Explicate the photoelectric and piezoelectric transducers.
- CO5 Infer the knowledge on different display and recording devices for various applications.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	-	-	-	-	-	1	1
CO 2	3	2	1	1	1	-	-	-	-	-	-	-	1	1
CO 3	3	2	1	1	1	-	-	-	-	-	-	-	1	1
CO 4	3	2	1	1	1	-	-	-	-	-	-	-	1	1
CO 5	3	2	1	1	1	-	-	-	-	-	-	-	1	1

Mapping of COs with POs and PSOs

1:	Slight	(Low)
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- 2: Moderate (Medium)
- 3: Substantial (High)
- "-" No correlation

22ITT21

Preamble:

UNIT 1 BASICS OF C PROGRAMMING

Introduction to Programming – Introduction to C - Structure of C program – Compilation and Execution - C Tokens - Keywords, Variables, Constants - Data Types - Input/output statements -Operators: Precedence and Associativity - Expressions – Type Conversion and Typecasting - Decision control and Looping statements - Preprocessor directives. Case study: EB Bill Generation

UNIT 2 ARRAYS AND STRINGS

Introduction to Arrays: Declaration, Initialization – One dimensional array –Linear Search, Binary Search. Two dimensional arrays – Matrix Operations (Addition, Multiplication and Transpose) – Strings - String operations: length, compare, concatenate, copy, reverse - Array of Strings. Case Study: Sorting of student namelist in a classroom

UNIT 3 FUNCTIONS AND POINTERS

Introduction to functions - Built-in functions (string functions, math functions) - User-defined functions - Function prototype, function definition, function call - Parameter passing: Pass by value, Pass by reference - Recursion. Pointers - Declaration - Pointer expression and Pointer arithmetic -Array of pointers -Function Pointers - Case Study: Scientific calculator using built-in functions and user defined functions

UNIT 4 STRUCTURES. UNION AND ENUMERATED DATATYPES

Structure - Nested structures – Pointer and Structures – Array of structures – Structure and Functions – Union - Example Programs using structures and Unions – Enumerated Data types. Case Study: Create employee datasheet using Structure, Union.

UNIT 5 FILE PROCESSING

Introduction to Files – Using Files in C – Reading and writing Files – Types of file processing: Sequential access, Random access - Functions for selecting a record - Command line arguments -Storage classes – Dynamic memory allocation. Case study: Processing stock details of Library.

TEXT BOOKS:

- 1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
- 2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 3rd Edition, Oxford University Press, 2013.

REFERENCES:

- 1.Paul Deitel and Harvey Deitel, C How to Program with an Introduction to C++, Eighth edition, Pearson Education, 2018.
- 2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
- 3.Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.

e-RESOURCES:

Page 67

TOTAL: 45 PERIODS

This course aims at giving adequate exposure to students on the principles of procedural programming language. The course is intended to introduce the students to computational thinking and make the students develop C Programs using basic programming constructs. The course will

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- 1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
- 2. https://onlinecourses.nptel.ac.in/noc22_cs45/preview

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Apply suitable data type and control statements in C language to solve the given problem.
- CO2 Experiment the given list of data through sorting or searching techniques in C.
- CO3 Develop C programs using functions and pointers to access arrays.
- CO4 Apply user defined data types in C such as structures and unions to solve problems.
- CO5 Develop C programs to store and process the given data using files.

	PO	PSO	PSO											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	2	-	2	1	-	-	-	-	1	-	-
2	3	2	3	2	-	2	1	-	-	-	-	1	-	-
3	3	2	3	2	-	2	1	-	-	-	-	1	-	-
4	3	2	3	2	-	2	1	-	-	-	-	1	-	-
5	3	2	3	2	-	2	1	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

22MDT34 **ANALOG AND DIGITAL ELECTRONICS**

Pre-requisites : 22ECT22 - Electric Circuits and Machines

Preamble

The course introduces the biasing of BJTs, FETs and MOSFETs in constructing amplifiers. It also details the structure and properties of feedback for analyzing amplifiers, wave shaping and multivibrator circuits. The course also exposes the fundamental concepts used in the digital systems.

UNIT 1 BIASING OF BJT AND FET

Bias Stability – Need for biasing – quiescent point – DC load line and AC load line – Thermal runaway. Stability factors, Different types of biasing circuits - Fixed bias - Collector to base bias - Voltage divider bias- Biasing the FET.

UNIT 2 FEEDBACK AMPLIFIERS

General Feedback Structure, Determining the Loop Gain, Properties of negative feedback, Basic Feedback Topologies, Methods of identifying feedback topology and feedback factor- Voltage Series Feedback- Current Series Feedback- Current Shunt Feedback- Voltage Shunt Feedback.

UNIT 3 WAVE SHAPING AND MULTIVIBRATOR CIRCUITS

RC & RL Integrator and Differentiator circuits- Diode clippers, Clampers. Collector coupled Astable multivibrator and Monostable multivibrator, Schmitt trigger circuit – UJT saw tooth waveform generator.

UNIT 4 MINIMIZATION TECHNIQUES AND LOGIC GATES

Number Systems - De-Morgan's Theorem- Minimization of Boolean expressions- The Karnaugh Map -Sum of Products (SOP) - Product of Sums (POS) - Don't care conditions- AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR Implementations of Logic Functions using gates, NAND- NOR implementations.

UNIT 5 MEMORY DEVICES

Classification of memories- ROM and RAM organization - Programmable Logic Array (PLA) -Programmable Array Logic (PAL) - Field Programmable Gate Array (FPGA).

Lecture : 45; Tutorial : 15; Total : 60PERIODS

TEXT BOOKS:

- Salivahanan S. & Sureshkumar N. "Electronic Devices and Circuits", McGraw Hill Education, 1. ThirdEdition, Fifth Reprint, 2014.
- 2. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCES:

- Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Edition, 1. Pearson Education PHI, 2009.
- S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition, Vikas Publishing 2. House Pvt. Ltd, New Delhi, 2006.
- J. Millman, C C Halkias & Satyabrata Jit, "Electronic Devices & Circuits", Tata McGraw 3. Hill,4thEdition, 2015.
- David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008. 4.
- Thomas L.Floyd, "Digital Fundamentals", Pearson Education, England, 2021. 5.
- Charles H. Roth Jr, "Fundamentals of Logic Design", Seventh Edition, Jaico Publishing House, 6. Mumbai, 2014.

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e-Resources:

- 1. http://nptel.ac.in/courses/117101106/1, "Analog Circuits" Prof.A.N.Chandorkar, IIT Bombay.
- 2. http://www.satishkashyap.com/2012/02/digital-electronic-circuits-by-shouri.html,"Digital Electronics", Dr.Shouri Chatterjee, IIT- Delhi.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Design transistor amplifier circuits with Fixed, Collector to Base, Voltage divider biasing techniques.
- CO2 Analyze feedback amplifiers and identify suitable amplifier for a given application using gain, input- output resistance and bandwidth.
- CO3 Design wave shaping and multivibrator circuits using active and passive components for a given application.
- CO4 Present the digital fundamentals and methods for simplifying Boolean expressions.
- CO5 Familiarize the concept of memories and programmable logic devices

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO 2	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO 3	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO 4	3	2	1	1	1	-	-	-	-	-	-	1	1	-
CO 5	3	2	1	1	1	-	-	-	-	-	-	1	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22HST21 TAMILS AND TECHNOLOGY / தமிழரும்தொழில்நுட்பமும் L Т 1 0

(For Students admitted in AY 2022- 23 only)

UNIT 1 WEAVING AND CERAMIC TECHNOLOGY

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

UNIT 2 DESIGN AND CONSTRUCTION TECHNOLOGY

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram -Sculptures and Temples of Mamallapuram - Great Temples of Cholas and otherworship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- ThirumalaiNayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT 3 MANUFACTURING TECHNOLOGY

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coins as source of history - Minting of Coins - Beads making-industries Stone beads - Glass beads- Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types describedin Silappathikaram.

UNIT 4 AGRICULTURE AND IRRIGATION TECHNOLOGY

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry -Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries -Pearl -Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society

UNIT 5 SCIENTIFIC TAMIL & TAMIL COMPUTING

Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TEXT BOOKS AND REFERENCES:

- தமிழகவரலாறு மக்களும்பண்பாடும் கே.கே.பிள்ளை (வெளியீடு: 1. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
- கணினித்தமிழ் முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்). 2.
- கீழடி வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (கொல்லியல் 3 துறை வெளியீடு)
- 4 பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
- Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL (in print) 5
- Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International 6 Institute of Tamil Studies.
- 7 Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
- Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) 8 (Published by: International Institute of Tamil Studies).
- 9 Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by:Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
- 10 Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)
- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book 11 and Educational Services Corporation, Tamil Nadu)
- Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) Reference Book. 12

TOTAL : 15 PERIODS

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22MDL31

BIOSCIENCES LABORATORY

Pre-requisites: Nil

Preamble:

The Course enables the students to provide practice to learn fundamental approaches for experimentally investigating biochemical and physiological problems.

LIST OF EXPERIMENTS

- 1. General tests for carbohydrates, proteins and lipids.
- 2. Estimation of blood glucose.
- 3. Estimation of creatinine
- 4. Estimation of urea
- 5. ESR, PCV, MCH, MCV, MCHC, total count of RBCs and hemoglobin
- 6. Weber's and Rinnee's test for auditory conduction.
- 7. Ishihara chart for colour blindness and Snellen's chart for myopia and hyperopia –by letters reading and ophthalmoscope to view retina
- 8. Study of parts of compound microscope
- 9. Identification of microorganism by Simple staining
- 10. Identification of microorganism by Gram staining
- 11. General tests for carbohydrates, proteins and lipids.
- 12. Estimation of blood glucose.

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- 1. ExperimentandIdentifythechemicalandmicroscopiccomponentsofbiologicalsamplesunderdifferent physiologicalconditions.
- 2. Experiment and quantify the abnormal constituents in biological samples and interpret common result patterns related to different pathological conditions.
- 3. Perform physiological tests that examine the function of various components of a body system.
- 4. Experiment by using the laboratory microscope.
- 5. Experiment and identify the bacteria in the biological sample.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO2	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO3	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO4	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO5	3	2	1	1	1	-	-	-	-	1	1	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDL32

Pre-requisites: Nil

Preamble:

The Course enables the students to study the various characteristics of transducers, signal conditioning circuits and their biomedical applications.

LIST OF EXPERIMENTS

- 1. Characteristics of strain gauges.
- 2. Measurement of Force or Weight by Load Cell
- 3. Displacement measurement using LVDT.
- 4. Characteristics of temperature sensors
- 5. Measurement of skin temperature-contact and non-contact method
- 6. Characteristics of Light Sensors-Light Dependent Resistor, Photodiode and PhotoTransistor
- 7. Measurement of SpO2
- 8. Bridge Circuits for Measurement of Resistance, capacitance and inductance
- 9. Measurement of respiration rate

10. Study the characteristics of X-Y Recorder.

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Experiment to verify the characteristics of transducer.
- 2. Analyze the various transducers in biomedical applications
- 3. Design the bridge circuits to find out unknown resistor, inductor and capacitor values.
- 4. Analyze the working of X-Y recorders
- 5. Design the measurement systemfor various biomedical applications

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	-	-	-	-	1	1	-	-	-
CO2	3	2	1	1	1	-	-	-	-	1	1	-	-	-
CO3	3	2	1	1	1	-	-	-	-	1	1	-	-	-
CO4	3	2	1	1	1	-	-	-	-	1	1	-	-	-
CO5	3	2	1	1	1	-	-	-	-	1	1	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22ITL21

C PROGRAMMING LABORATORY

Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to solve Engineering problems using C programming language.

LIST OF EXPERIMENTS

- 1. If the three sides of a triangle are entered through the keyboard, write a program to check whether the triangle is valid or not. The triangle is valid if the sum of two sides is greater than the largest of the three sides.
- 2. A university has the following rules for a student to qualify for a degree with A as the main subject and B as the subsidiary subject:

(a) He should get 55 percent or more in A and 45 percent or more in B.

(b) If he gets than 55 percent in A he should get 55 percent or more in B. However, he should get at least 45 percent in A.

(c) If he gets less than 45 percent in B and 65 percent or more in A he is allowed to reappear in an examination in B to qualify.

(d) In all other cases he is declared to have failed.

Write a program to receive marks in A and B and Output whether the student has passed, failed or is allowed to reappear in B.

- 3. Twenty-five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many are negative, how many are even and how many odd.
- 4. Write a program that extracts part of the given string from the specified position. For example, if the sting is "Working with strings is fun", then if from position 4, 4 characters are to be extracted then the program should return string as "king". Moreover, if the position from where the string is to be extracted is given and the number of characters to be extracted is 0 then the program should extract entire string from the specified position.
- 5. A positive integer is entered through the keyboard, write a program to obtain the prime factors of the number. Modify the function suitably to obtain the prime factors recursively.
- 6. Write a function to compute the distance between two points and use it to develop another function that will compute the area of the triangle whose vertices are A(x1, y1), B(x2, y2), and C(x3, y3). Use these functions to develop a function which returns a value 1 if the point (x, y) lines inside the triangle ABC, otherwise a value 0.
- 7. An animal could be a canine (dog, wolf, fox, etc.), a feline (cat, lynx, jaguar, etc.), a cetacean (whale, narwhal, etc.) or a marsupial (koala, wombat, etc.). The information whether a particular animal is canine, feline, cetacean, or marsupial is stored in bit number 0, 1, 2 and 3 respectively of a integer variable called type. Bit number 4 of the variable type stores the information about whether the animal is Carnivore or Herbivore. For the following animal, complete the program to determine whether the animal is a herbivore or a carnivore. Also determine whether the animal is a canine, feline, cetacean or a marsupial.
- 8. There is a structure called employee that holds information like employee code, name, date of joining. Write a program to create an array of the structure and enter some data into it. Then ask the user to enter current date. Display the names of those employees whose tenure is 3 or more than 3 years according to the given current date.

- 9. Given a list of names of students in a class, write a program to store the names in a file on disk. Make a provision to display the nth name in the list (n is data to be read) and to display all names starting with S.
- 10. Assume that a Master file contains two fields, Roll no. and name of the student. At the end of the year, a set of students join the class and another set leaves. A Transaction file contains the roll numbers and an appropriate code to add or delete a student. Write a program to create another file that contains the updated list of names and roll numbers. Assume that the Master file and the Transaction file are arranged in ascending order by roll numbers. The updated file should also be in ascending order by roll numbers.

TOTAL: 45 PERIODS

Course Outcomes:

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

- CO1 Develop and test the C program to solve a given problem statement using suitable data types, decision making and control statements.
- CO2 Write the C program to process the given list of data using the concepts of arrays and strings.
- CO3 Develop and test the C program for the given problem statement using functions and recursion.
- CO4 Apply the concepts of structure and union to solve a given problem statement in C.
- CO5 Construct the C program to store and process the given data using files.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO2	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO3	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO4	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO5	2	3	3	3	2	1	1	-	1	-	-	2	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

ENGLISH FOR PROFESSIONALS

22MCL04

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

UNIT 1 LISTENING

Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing UNIT 2 READING Poem - Robert Frost - Road Not Taken- Decision Making- Biographies of Famous Personalities.- Reading

and Note Making on News Articles **UNIT 3 WRITING**

Letter Writing - Letters Seeking Permission- Letters Seeking Apology - Letters Requesting Certificates – Analytical Writing

UNIT 4 SPEAKING

Watching Presentations - Presentation Techniques - Group Presentation - Group Discussion

UNIT 5 VERBAL ABILITY

Parajumbles - Sentence Completion - Identifying Common Errors

REFERENCES:

- 1. M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
- 2. Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1st Edition, New Delhi, 2008.

e. RESOURCES :

- 1. https://agendaweb.org/listening/audio-books-mp3.html
- 2. https://www.ndtv.com/world-news
- 3. http://learnenglishteens.britishcouncil.org/skills/reading
- 4. <u>https://www.bbc.com/</u>

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Analyze the given listening material and answer the questions correctly employing listening techniques.
- CO2 Analyze the given reading material and answer the questions correctly employing reading techniques.
- **CO3** Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.
- **CO4** Take part effectively in group discussion, conforming no profession norms and to give extemporaneous presentation.
- **CO5** Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

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TOTAL: 30 PERIODS

Cos/POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

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22MCL04

ENGLISH FOR PROFESSIONALS (III / IV Semester) (Students admitted during 2023-2024 onwards)

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

UNIT 1 LISTENING

	0
Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing	
UNIT 2 READING	7
Reading for gist - Biographies of Famous Personalities - Reading and Note Making on News Articles	
UNIT 3 WRITING	5
Letter Writing - Seeking Permission- Seeking Apology - Letters Requesting Certificates – Analytical	
Writing and Issue based writing	
UNIT 4 SPEAKING	9
Presentation Techniques - Presentation with visual aids – Extempore and Impromptu talk	
UNIT 5 VERBAL ABILITY	4
Parajumbles - Sentence Completion - Identifying Common Errors	
TOTAL: 30 PER	IODS

REFERENCES:

- 1. M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
- 2. Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1st Edition, New Delhi, 2008.

e. **RESOURCES** :

- 1. <u>https://agendaweb.org/listening/audio-books-mp3.html</u>
- 2. <u>https://www.ndtv.com/world-news</u>
- 3. <u>http://learnenglishteens.britishcouncil.org/skills/reading</u>
- 4. <u>https://www.bbc.com/</u>

Course Outcomes: Upon completion of the course, students will be able to:

- **CO1** Analyze the given listening material and answer the questions correctly employing listening techniques.
- CO2 Analyze the given reading material and answer the questions correctly employing reading techniques.
- **CO3** Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.
- **CO4** Take part effectively in group discussion, conforming to professional norms and to give extemporaneous presentation.
- **CO5** Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

Cos/POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-
Mapping Average	-	-	-	-	3	-	-	-	3	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MDT41

MEDICAL EQUIPMENT - I

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Pre-requisites : Nil

Preamble

The Course enables the students to describe the working of Diagnostic and Therapeutic Engineering Equipment.

UNIT 1 BIOPOTENTIALELECTRODESANDBIOAMPLIFIER

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode-skin interface, halfcell potential, polarization electrode – non-polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers.

UNIT 2 CARDIAC MEASUREMENTS

Electrocardiograph, Right leg driven ECG amplifier, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting. Cardiac Pacemaker- Internal and External Pacemaker–Batteries, AC and DC Defibrillator-Internal and External, Defibrillator Analyzers.

UNIT 3 NEUROLOGICALMEASUREMENTS

EEG -10-20 electrode system- Montage- Multi-channel EEG recording system, sleep patterns, Evoked Potential-EMG – unipolar and bipolar mode- Electro occulograph(EOG),Electro retinography(ERG), Audiometer-Puretone,Speech.Galvanicskinresistance(GSR)-Biofeedbackinstrumentation, EEG machine maintenance and troubleshooting.

UNIT 4 MEASUREMENTOFNON-ELECTRICALPARAMETERS

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 5 PATIENTMONITORING, TELEMETRY AND PATIENTS AFETY

Patient monitoring systems, ICU/CCU Equipment's, Infusion pumps, bed side monitors, Central consoling controls-Telemetry- Portable and Land line- 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.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, Fourth Edition 2015.
- 2. Khandpur R.S, "Handbook of Biomedical Instrumentation", McGraw-Hill Education, Third Edition 2014.
- 3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

REFERENCES:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement",

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PearsonIndia,SecondEdition2015.

2. Myer Kutz," Standard Handbook ofBiomedicalEngineeringandDesign",McGrawHillPublisher,2003.

e-Resources:

1. https://www.youtube.com/watch?v=XEv4K1gHUEo,"Recordinga12leadECG",Nicksmith, Central Manchester

University hospitals.

2. https://www.youtube.com/watch?v=2Cs4CJBaTN4,"IntroductiontoBiopotentials",SarwarK,Uni versityofTexas.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Differentiate different bio potentials electrode for measuring electrical physiological measurements.
- CO2 Design the bio amplifiers for various physiological recordings
- CO3 Describe the working & recording setup of basic cardiac equipment.
- CO4 Understanding the devices for measurement related to cardiology.
- CO5 Explain various for non-electrical physiological measurements.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 2	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 3	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO 4	3	2	1	1	1	1	1	-	-	1	1	1	-	1
CO 5	3	2	1	1	1	1	1	-	-	1	1	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

BIO CONTROL SYSTEMS

Pre-requisites : Nil

Preamble

The Course enables the students to impart the concept and different mathematical techniques applied in analyzing any given system in time domain, frequency domain and stability and to develop the knowledge of modeling of physiological control system.

UNIT 1 MODELING OF SYSTEMS

Terminology and basic structure of control system, examples of a control system, transfer functions, modeling of electrical systems, translational and rotational mechanical systems, and electromechanical 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.

UNIT 2 TIME RESPONSE ANALYSIS

Test input signals, 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 3 STABILITY ANALYSIS

Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of root locus, study of stability, Nyquist stability criterion,.

UNIT 4 FREQUENCY RESPONSE ANALYSIS

Frequency response, definition of gain margin and phase margin, determination of gain margin and phase margin using Bode plot, Polar plot, determination of closed loop response using M and N circles, Nichol's chart to computer response frequency and bandwidth.

UNIT 5 PHYSIOLOGICAL CONTROL SYSTEMS

Example of physiological control system, difference between engineering and physiological control systems, linearmodels ofphysiological systems-respiratorymechanics-Modelofcardiacoutput-Stability analysis of Pupillary light reflex, introduction to simulation.

TEXT BOOKS:

- 1. M.Gopal"Control Systems Principles and Design", Tat aMcGraw Hill, Fourth Edition2012.
- 2. MichaelCKKhoo, "PhysiologicalControlSystems", IEEEPress, JohnWiley&Sons, 2018.

REFERENCES:

- 1. FaridGolnaraghi,BenjaminC.Kuo,"AutomaticControlSystems",JohnWiley&Sons,2009.
- 2. JohnEnderleSusanBlanchard,JosephBronzino"IntroductiontoBiomedicalEngineering",Thirdediti on, Academic Press,2012.
- 3. RichardC.Dorf,RobertH.Bishop,"Moderncontrolsystems",PearsonEducation,TwelfthEdition, 2013.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/107106081/, 'ControlSystems', Prof.C.S.ShankarRam, IITMadras</u>.
- 2. <u>http://nptel.ac.in/courses/108103007/, 'AdvancedControlSystems', Prof.SomanathMajhi, IIT,</u> Guwahati.

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Lecture : 45; Tutorial : 15; TOTAL : 60 PERIODS

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3. https://www.edx.org/course/system-dynamics-health-sciences-witsxhsd101x#!, "System dynamics for Health Sciences", David Rubin Adjunct Professor, Biomedical Engineering University of the Witwatersrand.

Course Outcomes: Upon completion of this course, students will be able to:

- Identify the different types of control systems, and interpret the system concepts and different CO1 Mathematical techniques for analyzing the given system.
- Analyze the time domain of the system using different mathematical techniques. CO2
- Apply various techniques for analyzing the stability of the system. CO3
- CO4 Analyzethefrequencydomainofthesystemusingdifferentgraphicalplots.
- Use the knowledge of control system modeling to design and evaluate the models of CO5 physiological control system.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	1	1	-	-	-	-	1	1	1	-	-
CO 2	3	1	1	1	1	-	-	-	-	1	1	1	-	-
CO 3	3	1	1	1	1	-	-	-	-	1	1	1	-	-
CO 4	3	1	1	1	1	-	-	-	-	1	1	1	-	-
CO 5	3	1	1	1	1	-	-	-	-	1	1	1	-	-
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Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDT43 LINEAR AND DIGITAL INTEGRATED CIRCUITS L

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Pre-requisites :22MDT34-Analog and Digital Electronics

Preamble

This course introduces the basic building blocks of the integrated circuits along with fundamental concepts in digital logic systems and linear integrated circuits. It also provides the knowledge of combinational and sequential circuits.

UNIT 1 OPERATIONAL AMPLIFIERS

The characteristics of ideal operation of op-amp, Slew rate, Offset voltage, Bias current, CMRR, Bandwidth, Equivalent circuit of an op-amp, Virtual ground concept, Linear application of op-amp - Inverting and Non- inverting amplifiers, Differential amplifiers, Differentiator and Integrator. Non Linear applications- Comparator, Schmitt triggers, Precision Diode Half wave and Full wave rectifiers.

UNIT 2 ACTIVE FILTERS AND SIGNAL GENERATORS

Active Filters - Low pass, High pass, Band pass and Band stop filters. Oscillators – RC phase shift and Wein-Bridge. Waveform generators – Square, Triangular and Saw tooth.

UNIT 3 TIMER, PLL, A/D AND D/A CONVERTERS

555 Timer- Internal diagram and its applications- monostable multivibrator, astable multivibrator, Phase Locked Loop (565) and its applications. Binary weighted DAC and R-2R DAC, Successive approximation ADC.

UNIT 4 COMBINATIONAL CIRCUITS

Half adder and Full adder- Multiplexers and De-multiplexers - Decoders and Encoders- Binary Multiplier- Binary Divider- Code converters - Magnitude Comparator.

UNIT 5 SEQUENTIAL CIRCUITS

Flip Flops- RS, D, T, JK Flip Flops- Characteristics equations and exciting tables, Edge triggering - Level Triggering - Asynchronous Up/Down counter - Synchronous Up/Down counters, Design of modulo - N counters, Registers - Shift registers - Sequence generators.

TEXT BOOKS:

- 1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., New Delhi, 2018
- 2. M. Morris Mano and Michael D. Ciletti, "Digital design" Fifth Edition Pearson Education, New Delhi, 2013.
- 3. Ramakant A. Gayakwad, "Op-AMP and Linear Ics", Fourth Edition, Prince Hall, 2016.

REFERENCES:

- 1. S.Salivahanan and S. Arivazhagan,"Digital Circuits and Design" fourth edition, Vikas publishing house pvt. ltd,2012
- 2. Charles H. Roth Jr, "Fundamentals of Logic Design", Seventh Edition, Jaico Publishing House, Mumbai, 2014.
- 3. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

e-Resources:

1. http://nptel.iitm.ac.in/courses/117106086,"Digital Circuits and Systems-video", Prof.S.Srinivasan,

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TOTAL : 45 PERIODS

IIT -Madras.

- 2. http://www.satishkashyap.com/2012/02/digital-electronic-circuits-by-shouri.html,"Digital Electronics", Dr.Shouri Chatterjee, IIT- Delhi.
- 3. http://nptel.ac.in/courses/117103063/26, "Ideal op-amp and its applications" Dr. Chitralekha Mahanta Department of Electrical and Communication Engineering Indian Institute of Technology, Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

- Design linear and non-linear circuits using op amp CO1
- CO2 Design active filters and signal generators using op-amp
- CO3 Design application circuits using 555 Timer, 565 PLL, A to D and D to A converters
- Analyze and design combinational circuits CO4
- CO5 Analyze and design sequential circuits

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	-	-	-	-	-	1	-
CO 2	3	2	1	1	1	-	-	-	-	-	-	-	1	-
CO 3	3	2	1	1	1	-	-	-	-	-	-	-	1	-
CO 4	3	2	1	1	1	-	-	-	-	-	-	-	1	-
CO 5	3	2	1	1	1	-	-	-	-	-	-	-	1	-
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Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDT44

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Pre-requisites : Nil

Preamble

To develop an understanding of physics principles underlying the imaging techniques and radiotherapy techniques.

UNIT 1 X-RAYEQUIPMENT

Nature of X-rays- Production of X-Rays- Interaction with matter- X- Ray Equipment (Block Diagram) – X-Ray Tube- the collimator- Bucky Grid- X-ray Image Intensifier tubes- Digital Radiography-Digital subtraction Angiography - Fluroscopy.

UNIT 2 COMPUTEDTOMOGRAPHY

Principles of tomography– CT Generations – Multiscale Helical CT imaging principles- Imaging system design. Image reconstruction techniques - back projection and iterative method. Image characteristics.

UNIT 3 MAGNETICRESONANCEIMAGING

Fundamentals of magnetic resonance- Basic NMR imaging system. Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession –Relaxation processes T1 and T2– Classification of NMR imaging methods- Discrimination based on Relaxation rates-NMR pulse sequences, Types of imaging sequences.

UNIT 4 NUCLEARMEDICINESYSTEMS

Introduction–RadioactiveEmissions-alpha–beta–gamma.Radiationdetectors–IonizationChambers–ScintillationDetectors.Pulseheightanalyzers–GammaCountingSystem–RectilinearScanner–GammaCamera - PET .

UNIT 5 RADIATIONTHERAPYANDRADIATIONSAFETY

Radiation therapy – linear accelerator–Cardinal Principles of Radiation Protection, Radiation Detection and Measurement, Dosimeter-Radiation protection in medicine- Radiation protection principles.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. R.Hendee and Russell Ritenour"MedicalImagingPhysics", Wiley-Liss, 4thEdition2002.
- 2. Faiz M.Khan, John P.Gibbons, "The Physics of Radiation Therapy", Wolters Kulwer , Philadelphia, 5th Edition, 2014.

REFERENCES:

- 1. StewartC.Bushong, "RadiologicScienceforTechnologists", ElsevierMosby, 8thEdition, 2004.
- 2. GopalB.Saha"PhysicsandRadiobiologyofNuclearMedicine"Springer,3rdEdition,2006.
- 3. SteveWebb, "ThePhysicsofMedicalImaging", Taylor&Francis, 2ndEdition, 2010.

e-Resources:

- 1. https://courses.edx.org/courses/UQx/BIOIMG101x, "Introduction to Biomedical Imaging", Prof. Dr. Graham Galloway, The University of Queensland.
- 2. http://www.imaios.com/en/e-Courses/e-MŘI,"eMRI-MRIstepbystep",IMAIOSSAS,France

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Course Outcomes: Upon completion of this course, students will be able to:

- Interpret the construction and production of X-rays in imaging systems. CO1
- Demonstrate the knowledge of concepts & principles associated with the operation of CT imaging equip CO₂ ment.
- DifferentiaterelaxationprocessandNMRpulsesequencesinmagneticresonanceimaging. CO3
- Suggestanappropriatenuclearmedicinesystemsandtechniqueforadiagnosisenvironment. CO4
- Identify the need for radiation protection and various monitoring techniques used for self, staff, CO5 and patients.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	2	1	1	-	-	-	-	1	1	1	-	-
CO 2	3	1	2	1	1	-	-	-	-	1	1	1	-	-
CO 3	3	1	2	1	1	-	-	-	-	1	1	1	-	-
CO 4	3	1	2	1	1	-	-	-	-	1	1	1	-	-
CO 5	3	1	2	1	1	-	-	-	-	1	1	1	-	-
l · Slight (La	147)	2.1	Andore	nto (M	dium)	3. 511	hetanti	al (Hi	ah)	" <u>"</u> "	Jo cor	rolation	,

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDC41

Preamble

Digital Signal Processing provides an introduction to the basic concepts of signal processing methods and to acquire knowledge of analysis of systems using various transformation techniques. It provides students to realize about different filter structure and also to develop algorithm for signal processing.

UNIT 1 DISCRETE AND FAST FOURIER TRANSFORM

Introduction to DFT – Efficient computation of DFT – Properties of DFT – FFT Algorithms – Decimation in Time (DIT) and Decimation in Frequency (DIF) Algorithms – Linear and Circular Convolution.

UNIT 2 IIR FILTER DESIGN

Analog filter design – Discrete time IIR filter from analog filter – IIR filter design: Impulse Invariance, Bilinear transformation technique – Realization using Direct form I, Direct form II and Cascade forms.

UNIT 3 FIR FILTER DESIGN

Linear phase FIR filters – Filter design: windowing techniques (Rectangular Window, Hamming Window), Realization of FIR filters Transversal and Linear phase structures.

UNIT 4 FINITE WORD LENGTH EFFECTS

Fixed point and floating point number representations – Quantization – Truncation and Rounding errors – Quantization noise – coefficient quantization error – Product quantization error – Overflow error – Round-off noise power – limit cycle oscillations due to product round-off and Overflow errors – Principle of scaling.

UNIT 5 MULTIRATE SIGNAL PROCESSING AND DSP APPLICATIONS

Introduction to Multirate signal processing – Decimation – Interpolation – Sampling rate conversion by a rational factor – Adaptive Filters: Introduction – Applications of adaptive filtering to equalization-Introduction to DSP Processor (TMS320C50).

TOTAL(Lecture:45+Practical :15) : 60 Periods

List of Experiments:

- 1. Computation of Discrete Fourier Transform of a discrete signal.
- 2. Design of IIR Butterworth filter using bilinear transformation method.
- 3. Design of Chebyshev IIR filter using one to one mapping method.
- 4. Design of FIR filter using Hamming window.
- 5. Simulation of up sampling and down sampling.

TEXT BOOKS:

- 1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing Principles, Algorithms & Applications", Pearson Education / Prentice Hall, Fourth Edition, 2007.
- 2. Sanjit K. Mitra, "Digital Signal Processing A Computer Based Approach", McGraw Hill, 4th edition 2013.

REFERENCES:

- 1. Emmanuel C.Ifeachor, &Barrie.W.Jervis, "Digital Signal Processing", Pearson Education / Prentice Hall, Second Edition, 2002.
- 2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", Pearson, 8th Indian Reprint, 2004
- 3. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006.

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e-Resources:

- 1. http://www.nptelvideos.in/2012/12/digital-signal-processing.html, "Digital Signal Processing", Prof. S.C Dutta Roy, IIT Delhi
- 2. http://www.nptelvideos.in/2012/11/digital-signal-processing.html, "Digital Signal Processing", Prof.T.K.Basu, IIT Kharagpur

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Compute DFT of the discrete time sequence to determine the frequency spectrum by using FFT algorithms.
- CO2 Design digital IIR filter from the analog specifications by applying impulse invariance and bilinear transformation techniques.
- CO3 Design FIR filter for given specifications by using windowing and frequency sampling techniques.
- CO4 Illustrate the finite word length effects involved in digital filter design.
- CO5 Describe the multiple sampling rate conversion process by a suitable rational factor.

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	2	-	-	-	-	-	-	1	-	1	3	-
CO 2	2	3	3	-	-	1	-	-	-	1	-	1	3	-
CO 3	2	3	3	-	-	1	-	-	-	1	-	1	3	-
CO 4	2	3	2	-	-	1	1	-	-	1	-	1	3	-
CO 5	2	3	2	-	-	1	1	-	-	1	-	1	3	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

22MDC41

SIGNAL PROCESSING IN HEALTHCARE

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Pre-requisites : Nil

Preamble

This course concerns with analysis and synthesis of deterministic signals and their interaction with LTI systems. The analysis of Signals and its concepts play a vital role in signal processing, image and video processing and digital/analog communications. This course provides an introduction to the basic concepts of signal processing methods and to acquire knowledge of analysis of systems using various transformation techniques. It provides students to realize about different filter structure and also to develop algorithm for signal processing.

UNIT 1 CLASSIFICATION OF SIGNALS AND SYSTEMS

Continuous time signals - Discrete time signals - Impulse, Step, Ramp, Parabolic, Sinusoidal,

Exponential, Pulse -Operations on Signals - Classification of CT and DT signals: Deterministic & Random signals, Periodic & Aperiodic signals, Energy & Power signals, Causal & Non-causal, Even & Odd signals – CT systems and DT systems – Classification of systems: Static & Dynamic, Linear & nonlinear, Time-variant & Time invariant, Causal & non-causal, Stable & unstable.

UNIT 2 ANALYSIS OF CT AND DT SIGNALS

CT signal analysis - Fourier and Laplace Transforms, DT signal analysis - Z Transform - Inverse Z Transform (Partial fraction Method).

UNIT 3 DISCRETE AND FAST FOURIER TRANSFORM

Introduction to DFT – Efficient computation of DFT – FFT Algorithms: Decimation in Time FFT Algorithm - Decimation in Frequency FFT Algorithm – Convolution: Linear Convolution - Circular Convolution.

UNIT 4 DIGITAL FILTER DESIGN

IIR filter design: Analog filter design - Butterworth method - Impulse Invariance technique - Bilinear transformation technique - Realization structures: Direct form I - Direct form II. FIR filter design: Windowing techniques (Hamming Window, Hanning Window), Realization structures: Transversal and Linear phase structures.

UNIT 5 DSP APPLICATIONS IN HEALTHCARE

Introduction to Multirate Signal Processing – Decimation – Interpolation – Adaptive Filters: Introduction – Applications of adaptive filtering to equalization- Healthcare applications.

LIST OF EXPERIMENTS:

- Generation of elementary Discrete-Time sequences. 1.
- Fast Fourier Transform. 2.
- 3. Design of IIR Butterworth filter using bilinear transformation method.
- 4. Design of FIR filter using windowing techniques.
- 5. Simulation of up sampling and down sampling.

TOTAL (L:45+P:15): 60 PERIODS

TEXT BOOKS:

- 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, India, Second Edition, reprint, 2015.
- 2. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Pearson Education / Prentice Hall, Fourth Edition, 2007.

REFERENCES:

- 1. P. Ramesh Babu and R.Anandanatarajan, "Signals and Systems", Scitech Publication, 2014.
- 2. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
- Sanjit K. Mitra, "Digital Signal Processing A Computer Based Approach", McGraw Hill, 4th edition 3. 2013.
- Emmanuel C.Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Pearson Education / Prentice 4. Hall, Second Edition, 2002.

e-Resources:

- http://www.nptel.in/courses/117101055, "Signals and systems", Prof.V.M.Gadre, IIT Bombay. 1.
- http://www.nptelvideos.in/2012/12/digital-signal-processing.html, "Digital Signal Processing", Prof. 2. S.C Dutta Roy, IIT Delhi
- 3. http://www.nptelvideos.in/2012/11/digital-signal-processing.html, "Digital Signal Processing", Prof.T.K.Basu, IIT Kharagpur
- Course Outcomes: Upon completion of this course, students will be able to:
- Verify the linearity, stability, causality and time invariance properties of CT and DT systems. CO1
- Compute the frequency spectrum of the periodic CT signals using Fourier series and aperiodic CT CO2 signals using Fourier & Laplace transforms.
- Compute the DFT of the discrete time sequence to determine the frequency spectrum by using FFT CO3 algorithms.
- Design digital IIR and FIR filters from the analog specifications by applying various techniques. CO4
- CO5 Describe the multiple sampling rate conversion process by a suitable rational factor.

COs/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	1	-	1	-	1	-	-
CO 2	3	2	1	1	1	-	-	1	-	1	-	1	-	-
CO 3	3	2	1	1	1	-	-	1	-	1	-	1	-	-
CO 4	3	2	1	1	1	-	-	1	-	1	-	1	1	-
CO 5	3	2	1	1	1	-	-	1	-	1	-	1	1	-
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Mapping of COs with POs and PSOs

1: Sugni (Low)

2: Moaerale (Mealum)

5: Substantial (Hign)

No correlation

22MDT45

Pre-requisites : Nil

Preamble

This course aims at designing Analog and Digital communication systems that are used for the transmission of information. A detailed quantitative framework for analog and digital transmission techniques is addressed.

COMMUNICATION SYSTEMS

UNIT 1 ANALOGCOMMUNICATION

Introduction to Communication Systems: Modulation - Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

UNIT 2 DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) - Frequency Shift Keying (FSK) - Phase Shift Keying (PSK) - BPSK -OPSK - 8 PSK- Quadrature Amplitude Modulation (QAM) - 8 QAM- Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT 3 DATAANDPULSECOMMUNICATION

Data Communication: Standards Organizations for Data Communication – Data Communication Circuits- Error Detection and Correction Techniques - Data communication Hardware.

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM

UNIT 4 SOURCEANDERRORCONTROLCODING

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes

UNIT 5 MULTI-USERRADIOCOMMUNICATION

Global System for Mobile Communications (GSM) - Cellular Concept and Frequency Reuse - Channel Assignment and Hand off - Satellite Communication: Kepler's Law - satellite orbit - Geostationary Satellite – Satellite link modes – Bluetooth – Wi Fi.

TEXT BOOKS:

- Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Ed, Pearson Education, 1. 2009.
- 2. B.P.Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 3 rd Edition. 2007
- 3. S. Haykin, "Digital Communications", John Wiley, 2005

REFERENCES:

- 1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems", TMH, 3rd Edition, 2007
- 2. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004
- 3. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007.

e-Resources:

1. http://nptel.ac.in/courses/ 117101051 /, "Introduction to Digital Communication)", Prof. Bikash Kumar Dey, III, Bombay.

TOTAL : 45 PERIODS

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- 2. http://nptel.ac.in/courses/117101051 /, "Quantization , PCM and Delta Modulation", Prof. Bikash Kumar Dey, IIT, Bombay.
- 3. http://nptel.ac.in/courses/ 117101051 /, "Source Coding (Part 1)", Prof. Bikash Kumar Dey, IIT, Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Evaluate the AM, FM and PM systems with respect to performance and signal to noise ratio.
- CO2 Compare the performance of various shift keying techniques used in digital communication systems
- CO3 Analyze the characteristics of PAM, PTM and PCM modulation techniques and evaluate natural and flat top sampling techniques in digital pulse modulation
- CO4 Compare and contrast of Huffman and Shannon-Fano coding techniques for coding efficiency of lossless data compression=
- CO5 Summarize the basic physical and technical settings of mobile communication systems and illustrate the orbital parameters of a satellite.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 3	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 4	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 5	3	2	1	1	-	-	-	-	-	-	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

UNIT 4 SOURCE AND ERROR CONTROL CODING

capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes.

UNIT 5 MULTI-USER RADIO COMMUNICATION

Global System for Mobile Communications (GSM) - Cellular Concept and Frequency Reuse - Channel Assignment and Hand off - Satellite Communication: Kepler's Law - satellite orbit - Geostationary Satellite – Satellite link modes – Bluetooth – Wi Fi – 5G.

TEXT BOOKS:

- Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Ed, Pearson Education, 1. 2009.
- 2. B.P.Lathi,", "Modern Digital and Analog Communication Systems", 4th Ed, Oxford University, 2011.
- Haykin,", "Digital Communications Systems", 4th Ed, Wiley, 2013. 3.

REFERENCES:

- H.Taub, D L Schilling and G Saha, "Principles of Communication", 4th Edition, McGraw Hill 1. Education, 2017
- Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2006 2.
- Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson 3. Education, 2010.

e-Resources:

22MDT45

Pre-requisites : Nil

Preamble

This course aims at designing Analog and Digital communication systems that are used for the transmission of information. A detailed quantitative framework for analog and digital transmission techniques is addressed.

COMMUNICATION SYSTEMS

UNIT 1 ANALOG COMMUNICATION

Introduction to Communication Systems: Modulation - Types - Need for Modulation - Amplitude Modulation - Evolution and Description of SSB Techniques - Frequency and Phase Modulation: Relationship between FM and PM- FM Transmitters: Direct and Indirect method - FM Receiver -Comparison of various Analog Communication Systems (AM – FM – PM).

UNIT 2 DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) - Frequency Shift Keying (FSK) - Phase Shift Keying (PSK) -Ouadrature Amplitude Modulation (OAM) – 8 OAM - 16 OAM - Comparison of various Digital Communication Systems (ASK - FSK - PSK - QAM).

UNIT 3 DATA AND PULSE COMMUNICATION

Data Communication: Standards Organizations for Data Communication – Data Communication Circuits- Error Detection and Correction Techniques - Data communication Hardware.

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel

TOTAL: 45 PERIODS

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- 1. http://nptel.ac.in/courses/ 117101051 /, "Quantization , PCM and Delta Modulation", Prof. Bikash Kumar Dey, IIT, Bombay.
- 2. http://nptel.ac.in/courses/ 117101051 /, "Source Coding (Part 1)", Prof. Bikash Kumar Dey, IIT, Bombay.
- 3. http://nptel.ac.in/courses/ 117101051 /, "Introduction to Digital Communication)", Prof. Bikash Kumar Dey, III, Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Evaluate the AM, FM and PM systems with respect to performance and signal to noise ratio.
- CO2 Compare the performance of various shift keying techniques used in digital communication systems
- CO3 Analyze the characteristics of PAM, PTM and PCM modulation techniques and evaluate natural and flat top sampling techniques in digital pulse modulation
- CO4 Compare and contrast of Huffman and Shannon-Fano coding techniques for coding efficiency of lossless data compression
- CO5 Summarize the basic physical and technical settings of mobile communication systems and illustrate the orbital parameters of a satellite.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 2	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 3	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 4	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 5	3	2	1	1	1	-	-	1	-	1	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

(RATIFIED SYLLABUS)

22MDL41

BIOMEDICAL INSTRUMENTATION LABORATORY

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Pre-requisites: Nil

Preamble:

The Course enables the students to acquire the knowledge about measurement of various physiological parameters and to understand the fundamental principle and working of the biomedical instruments.

LIST OF EXPERIMENTS

- 1. Recording of ECG signal and Analysis
- 2. Recording of EMG signal
- 3. Recording of EEG signal
- 4. Measurement and Recording of Peripheral Blood Flow using blood flow meter
- 5. Measurement of Pulse rate and Analysis
- 6. Real Time biomedical signal acquisition and processing using LabVIEW
- 7. Measurement of pH and Conductivity
- 8. Recording of Audiogram
- 9. Measurement of Galvanic Skin Resistance(GSR)
- 10. Design of preamplifier to acquire biosignals.

TOTAL : 45 PERIODS

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PSO

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Course Outcomes: Upon completion of the course, students will be able to:

- 1. Acquire signals to record the performance of physiological activity using electrodes.
- 2. Create a scenario and analyze the performance and features of ECG,EEG ,EMG electrodes using biomedical instruments.
- 3. Demonstrate a hearing module setup using audiometer to analyze the hearing impairment levels and standards.
- 4. Examine the safety of any medical equipment to provide the quality assurance using safety analyzers.
- 5. Analyze the biomedical signal parameters using simulation tools.

PO PO PO COs/POs **PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9** 10 11 12 **CO1** 1 1 3 2 1 1 1 _ _ _ _ _ 1 1 1 1 1 **CO2** 3 _ 2 --_ _ 1 1 1 1 **CO3** 3 2 1 _ _ _ _ 1 1 **CO4** 1 3 2 1 1 _ -_ _ _

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Mapping of COs with POs and PSOs

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1: Slight (Low)

CO5

2: Moderate (Medium)

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3: Substantial (High)

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"-" No correlation

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22MDL42LINEAR AND DIGITAL INTEGRATED CIRCUITSL T P CLABORATORY0 0 2 1

Pre-requisites: 22ECL22-Electric Circuits and Electron Devices Laboratory Preamble:

This course is to provide practice in designing of combinational and sequential logic circuits. It also gives design experience in analog circuits in implementing amplifiers, active filters, waveform generators and multivibrators.

LIST OF EXPERIMENTS

- 1. Design of Inverting and Non-inverting amplifier using IC741.
- 2. Design of Integrator and Differentiator using IC741.
- 3. Design of Second order active low pass and high pass filters using IC741.
- 4. Designof RC phase shift and Wein bridge Oscillator using IC741.
- 5. Design of Astable and monostable multivibrator using IC 555 Timer.
- 6. Design and implementation of Half adder and Full adder.
- 7. Design and implementation of Encoder and Decoder.
- 8. Design and implementation of Multiplexer and De-multiplexer.
- 9. Design and implementation of Universal shift register.
- 10. Design and implementation of Synchronous and Asynchronous counters.

TOTAL : 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Design and test amplifiers and filters using IC741.
- 2. Design and test multivibrator circuits using IC 555.
- 3. Design and test the performance of combinational circuits.
- 4. Design and test the performance of Sequential circuits.
- 5. Design of counters.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO2	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO3	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO4	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO5	3	2	1	1	1	-	-	-	-	1	1	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

MEDICAL EQUIPMENT - II

Pre-requisites : Nil

Preamble

The Course enables the students to gain their knowledge level in ICU equipment and operation theatre equipment.

UNIT 1 RESPIRATORY EQUIPMENT

Pulmonary function test– spirometry– TLC graph– Principles of constant pressure and constant volume ventilators– Basic principles of electromechanical–Pneumatic and electronic ventilators- Ventilator machine installation, calibration and troubleshooting– Nebulizer.

UNIT 2 ELECTRO THERAPY EQUIPMENT

Electrotherapy– Electrodes– Stimulators for Nerve and Muscle– Stimulator for pain relief– Interferential current therapy– Functional Electrical Stimulation– High frequency heat therapy– Short wave diathermy– Microwave diathermy– Ultrasonic therapy– Lithotripsy.

UNIT 3 OPTICAL EQUIPMENT AND BIOTELEMETRY

Various types of Endoscopes– Fiber optic– Fluid optic– Integral Camera. Electron Microscope– Transmission and Reflection. Biotelemetry: Single channel, Multichannel telemetry systems.

UNIT 4 ICU EQUIPMENT

Infusion pumps– Hemodialysis Machine–Different types of Dialyzers–Performance analysis– Membranes– Dialysis machine installation, calibration and troubleshooting.

UNIT 5 OPERATION THEATRE EQUIPMENT

Suction apparatus– Principle of surgical diathermy– Electrosurgical techniques–Operation Theatre table & surgical lighting– Anesthesia machine– Gas supply system and delivery system– Vapor delivery system– Cryosurgery, Heart Lung Machine– Types of oxygenators– peristaltic pumps– Incubators..

TOTAL : 45 PERIODS

TEXT BOOKS:

- JohnG.Webster, "Medical Instrumentation Application and Design", John Wiley and sons, 5thEdition 2020.
- 2. KhandpurR.S, "Handbook of Biomedical Instrumentation", McGraw-Hill Education, 3rd Edition 2014.

REFERENCES:

- 1. LeslieCromwell, "BiomedicalInstrumentationandMeasurement", PearsonIndia, 2ndEdition2015.
- 2. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", McGraw Hill Publisher, 2003.
- 3. AndrewG.Webb, "PrinciplesofBiomedicalInstrumentation", CambridgeUniversityPress,1st Edition,2018.

e-Resources:

- https://onlinecourses.swayam2.ac.in/nou23_bt05/preview, Biomedical Instrumentation & Sensors, By Dr. Piyush Lotia and Mr. Thaneshwar Kumar Sahu, Chhattisgarh Swami Vivekanand Technical University, Bhilai
- https://onlinecourses.nptel.ac.in/noc24_bt32/preview, "Optical Spectroscopy and Microscopy : Fundamentals of optical measurements and instrumentation, Prof. Balaji Jayaprakash, IISc Bangalore.
 Course Outcomes: Upon completion of this course, students will be able to:

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- CO1 Acquire knowledge aboutmeasuringparametersrelatedtorespiratorysystemandrespiratory devices.
- CO2 Understandthephysicsunderlyingintheworkingofelectrotherapyequipment,LithotripsyandFES.
- CO3 Depicttheimportanceofopticalequipmentandbiotelemetryindiagnosticarea.
- CO4 Illustrate the application of assist device in critical care unit.
- CO5 Gain knowledge on Surgical Diathermy machines and their safety aspects, Anesthesia machine and the different controls.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	0	0	1	0	1	0	0	1	0
CO2	3	3	1	2	1	0	0	1	0	1	0	0	1	0
CO3	3	2	1	1	1	0	0	1	0	1	0	0	1	0
CO4	3	2	1	2	1	0	0	1	0	1	0	0	1	0
CO5	3	2	1	1	1	0	0	1	0	1	0	0	1	0

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDC51 MICROPROCESSORS AND EMBEDDED CONTROLLERS L T P C 3 0 2 4

Pre-requisites : 22MDT34 - Analog And Digital Electronics

Preamble

The purpose of this course is to provide students to gain knowledge about the architecture, instruction set, interrupts, interfacing, and programming of 8086 microprocessor and 8051 microcontroller. This course develops skills of students to program, design and implement smart system applications using Arduino. This course imparts knowledge on ARM7 microcontroller.

UNIT 1 8086 MICROPROCESSOR

Introduction to microprocessor: Overview of 8085 - 8086 Architecture - Memory segmentation - Memory banking - Pin diagram - Minimum mode configuration - Maximum mode configuration.

UNIT 2 8086 PROGRAMMING AND INTERFACING

Addressing modes - Instruction set - Assembler directives - Assembly language programming - Interrupts - 8255 Programmable Peripheral Interface - Interfacing of 8255 with 8086.

UNIT 3 8051 MICROCONTROLLER

8051 Architecture - Pin diagram - Memory organization - Addressing modes - Instruction set - Timers/Counters - Serial port - Interrupts - DC motor and stepper motor interfacing.

UNIT 4 ARDUINO MICROCONTROLLER

Arduino platform - Arduino IDE - Arduino types - Arduino Uno - Arduino programming: structure of Arduino C, variables, making decisions, functions - Digital I/O - Analog I/O - Hardware libraries - LCD and servo motor interfacing.

UNIT 5 ARM7 MICROCONTROLLER

ARM7 Architecture - Registers - Processor modes - Pipelining - Interrupts - Exceptions - Memory management - Addressing modes - Instruction set.

TOTAL : 45 PERIODS

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List of Experiments:

- 1. Arithmetic and logical operations using 8086 microprocessor.
- 2. Factorial program using 8086 microprocessor.
- 3. DC motor interfacing with 8051 microcontroller.
- 4. LCD interfacing with Arduino Uno
- 5. Interfacing of LED with ARM7 microcontroller.
- 6. Mini Project.

TEXT BOOKS:

- 1. A. K. Ray and K. M. Bhurchandi, "Advanced Microprocessors and Peripherals", McGraw Hill Education, 3rd Edition 2017.
- 2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson, 2nd Edition, 2013.
- 3. Simon Monk, "Programming Arduino', McGraw Hill, 3rd Edition, 2023.
- 4. Hung Q. Le, "ARM Microcontrollers: Theory and Practical Applications", Cognella Inc, 1st Edition, 2022.

REFERENCES:

1. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086/8088 Family Architecture, Programming and Design", Pearson, 2nd Edition, 2015.

- 2. John Uffenbeck: "8086/8088 family: "Design, Programming and Interfacing", Prentice Hall, 2nd Edition, 1998.
- Kenneth J. Ayala, "8051 Microcontroller: Architecture, Programming and Applications", Cenage 3. Learning, 3rd Edition, 2007.
- Bharat Acharya, "Microcontrollers and Applications", Tech-Neo Publications, 2020. 4.

e-Resources:

- https://swayam.gov.in/nd1 noc20 ee42/, "Microprocessors and Microcontrollers", Prof. Santanu 1. Chattopadhyay, Department of Computer Science and Engineering, Indian Institute of Technology, Kharagpur.
- 2. https://swayam.gov.in/nd1 noc20 ee11/, "Microprocessors and Interfacing", Prof. Shaik Rafi Ahamed, Department of Computer Science and Engineering, Indian Institute of Technology, Guwahati.
- 3. https://onlinecourses.swayam2.ac.in/aic20 sp04/, "Arduino", Prof. Kannan Moudgalya, Department of Chemical Engineering, Indian Institute of Technology, Bombay.
- 4. https://archive.nptel.ac.in/courses/106/105/106105193/, "Embedded System Design with ARM", Prof. Indranil Sengupta, Department of Computer Science and Engineering, Indian Institute of Technology, Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- Analyze the activities performed in T-States of fetch, read and write cycle in the minimum and CO1 maximum mode of 8086 microprocessor.
- Develop assembly language programs for the given problems using 8086 instruction set and CO₂ design circuits to interface 8255PPI with 8086 microprocessor.
- CO3 Design circuits to interface DC motor and stepper motor with 8051 microcontroller.
- Develop programs on Arduino platform for real world problems. CO4
- Explain architecture and features of ARM7 microcontroller. CO5

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	3	1	1						1	1	1	2
CO 2	2	3	3	1	1	1	1				1	1	1	2
CO 3	2	3	3	2	2	1	1				1	1	1	2
CO 4	2	3	2	2	2	1	1				1	3	1	3
CO 5	2	3	2	2	2						1	3	1	2
1: Slight (Low) 2: Moderate (Medium))	3: Su	bstanti	al (Hi	gh)	"_" N	No cor	relation	Į		

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Pre-requisites: Nil

Preamble

This course focuses on the fundamentals of object-oriented programming and Java programming language. Students will also be able to understand the fundamentals of packages, inheritance, and interfaces. The ability to create Java applications with threads, generic classes, exceptions, and I/O streams will be taught to the students. Additionally, using JAVAFX, students will be able to create graphic user interface applications.

UNIT 1 INTRODUCTION TO OOP AND JAVA

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- JavaDoc comments- I/O Basics – Reading and Writing Console I/O.

UNIT 2 INHERITANCE, PACKAGES AND INTERFACES

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch – Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access – Importing Packages – Interfaces.

UNIT 3 EXCEPTION HANDLING AND MULTITHREADING

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread CommunicationSuspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT 4 FILE I/O, GENERICS, STRING HANDLING

Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT 5 JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

TEXT BOOKS:

- 1. Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019
- 2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCES:

- 1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018 e-RESOURCES:
 - 1. https://archive.nptel.ac.in/courses/106/105/106105191/
 - 2. https://www.w3resource.com/java-tutorial/java-object-oriented-programming.php

Total : 45 Periods

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Course Outcomes: Upon completion of this course, students will be able to

- CO1 Apply the concepts of classes and objects to solve simple problems.
- CO2 Demonstrate the principles of inheritance, packages and interfaces in Java programming for a real world problem.
- CO3 Apply exception handling mechanisms and multithreaded model to solve real world problems using Java.
- CO4 Develop a Java application using I/O packages, string classes, generics concepts for the given problem.
- CO5 Integrate the concepts of event handling, JavaFX components and controls for developing GUI based applications.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	2	3	1	1	1	-	-	-	-	2	-	-
CO2	2	3	2	3	1	1	1	-	-	-	-	3	-	-
CO3	2	3	2	3	1	1	1	-	-	-	-	2	-	-
CO4	2	3	2	3	1	1	1	-	-	-	-	3	-	-
CO5	1	3	2	3	1	1	1	-	-	-	-	2	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MDL51

DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY LABORATORY

Pre-requisites: Nil

Preamble:

The Course enables the students to acquire the knowledge about measurement of various physiological parameters and to understand the fundamental principle and working of the biomedical instruments.

LIST OF EXPERIMENTS

- 1. Recording of various physiological parameters using patient monitoring system.
- 2. Recording of Heart sounds using PCG.
- 3. Measurement of Respiratory Parameters using spirometer.
- 4. Simulation of ECG signals using Physiograph.
- 5. Measurement of R-R interval and Heart rate in Simulated ECG signal using MATLAB Environment.
- 6. Measurement of Electrical safety parameters.
- 7. Measurement of output intensity from ultrasound diathermy.
- 8. Measurement of Flow rate using Syringe pump.
- 9. Measurement of Flow rate using Infusion pump.
- 10. Analyze the working of ESU–cutting and coagulation modes.
- 11. Study the working of Defibrillator and pacemaker.
- 12. Study of ventilators and Ultrasound Scanners.

TOTAL:45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Demonstrate various diagnostic and therapeutic techniques.
- 2. Analyze the different bio signals using suitable tools.
- 3. Experiment and Determine the flow rate for safer and micro administration of doses.
- 4. Assess different non-electrical parameters using various methodologies.
- 5. Analyze the respiration trajectories for various phases using inhalation and exhalation mechanisms.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	1	0	1	0	1	0	0	1	0
CO2	3	3	3	2	2	1	0	1	0	1	0	0	1	0
CO3	3	2	2	2	2	1	0	0	0	1	0	0	1	0
CO4	3	2	2	2	2	1	0	0	0	1	0	0	1	0
CO5	3	2	2	2	2	1	0	0	0	1	0	0	1	0

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22ITL53

JAVA PROGRAMMING LABORATORY

Pre-requisites: Nil

Preamble:

The goal of the course is to give students the ability to construct software using Java programming for practical applications. The ideas of classes, packages, interfaces, inheritance, exception handling, and file processing will be understood and applied by the students. Students are also capable of creating applications using event handling and general programming.

LIST OF EXPERIMENTS

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)

2. Develop stack and queue data structures using classes and objects.

3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.

4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.

5. Solve the above problem using an interface.

6. Implement exception handling and creation of user defined exceptions.

7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

8. Write a program to perform file operations.

9. Develop applications to demonstrate the features of generics classes.

10. Develop applications using JavaFX controls, layouts and menus.

SOFTWARE

- Operating Systems: Linux / Windows
- Front End Tools: Eclipse IDE / Netbeans IDE

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Develop simple Java programs to implement searching, sorting and linear ADT.

CO2 Design and develop Java programs using stack, queue ,inheritance and abstract class.

- CO3 Develop simple applications to demonstrate the use of exceptions and multithreading.
- CO4 Implement files and generics concepts for the given problem.

TOTAL: 45 PERIODS

CO5 Create GUIs and event driven programming applications for real world problems.

COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	-	1	1	-	1	2	2	2	-	-
CO2	2	1	3	1	-	1	1	-	2	3	3	2	-	-
CO3	2	2	1	2	1	1	1	-	1	2	1	3	-	-
CO4	2	2	1	3	-	1	1	-	3	1	1	1	-	-
CO5	1	3	3	1	3	2	2	-	1	1	1	1	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCT05APTITUDE AND LOGICAL REASONINGL T P C
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Preamble:

Aptitude tests are used to determine an individual's ability/potential to succeed in a certain task, with no prior knowledge or training and are frequently used as part of a pre-employment assessment. Aptitude tests are a proven tool used to identify those who are best equipped to carry out any given role.

A **logical reasoning test** is a form of testing that is widely used by corporate employers to help assess candidates during their recruitment process.

Course Outcomes :Upon completion of the course, students will be able to

- 1. Solve the given equation using appropriate simplification methods and compute time, work, capacity and identify the pattern by analyzing the given problem/scenario
- 2. Apply aptitude method of ratio and proportion to solve the given scenario.
- 3. Calculate time, speed, distance by applying suitable aptitude method for the given problem statement.
- 4. Calculate percentage and profit & loss for the given problem statement and Compute simple
- interest, compound interest for the given problem/scenario.
- 5. Use their logical thinking abilities to solve given problem involving direction sense, seating
- ^{3.} arrangement and coding & decoding.

UNIT 1	Unitary methods	6
Number Sys	stem, Time and Work, Pipes And Cisterns	
UNIT 2	Numerical Computation	6
Ratio and Pr	roportion, Problems on Ages	
UNIT 3	Numerical Estimation I	6
Time and D	istance, Problems on Trains, Boats and Streams	
UNIT 4	Numerical Estimation II	6
Percentage,	Profit and Loss, Simple Interest and Compound Interest	
UNIT 5	Logical Reasoning	6
Direction Se	ense, Seating Arrangements, Coding and Decoding	
		20 DEDIODO

REFERENCES:

- 1 Dr.R.S.Aggarwal, "Quantitative Aptitude for Competitive Examination", S.Chand Publications, 2022
- 2 Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", S.Chand Publications, 2022

TOTAL : 30 PERIODS
LISTENING & READING – Developing Listening & Reading Skills - Comprehension and Analysis – Listening & Reading for Main Idea - Specific Information - Cloze Test- Rearranging words and sentences

and progress. UNIT 1

UNIT 2 PRODUCTIVE SKILLS

RECEPTIVE SKILLS

SPEAKING & WRITING - Group Discussion and Practice – Mock GD - Structure – Types - Techniques -Keywords -Vital qualities - Attitude and Opinion - Expository and Persuasive Paragraphs – Picture Description

UNIT 3 ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS 4 Orientation to International English Language Testing System (IELTS) and other Competitive Examinations – MCOs

UNIT 4 CAREER SKILLS

Types of Interviews - FAQ's - Mock Interviews - Body Language - Team Work - Managing Time - Managing Stress - Negotiation Skills - Networking – Profile Creation (Linked in, Portfolio)

UNIT 5 VERBAL ABILITY

Synonyms and Antonyms - Idioms and Phrases - Sentence Construction and Improvement- Paraphrasing -Contextual Vocabulary - Verbal Analogy TOTAL: 30 PERIODS

REFERENCES:

- M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
- 2. Koneru Aruna 'Professional Communication' MC Graw Hill Education, Chennai, 2008.
- Upadhyay Meenakshi & Arun Sharma 'Comprehension Interpersonal & Communication Skills for General Studies Civil Services Preliminary Examination' MC Graw Hill Education, New Delhi, 2012.

e. RESOURCES :

- 1. <u>https://www.teachingenglish.org.uk/article/email-writing</u>
- 2. http://www.oxforddictionaries.com/words/writing-job-applications
- 3. <u>https://www.fresherslive.com/online-test/verbal-ability-test/questions-and-answers</u>
- 4. www.cambridgeenglish.org

Course Outcomes: Upon completion of the course, students will be able to:

- **CO1** Respond quickly and correctly to questions from different types of scripts, exhibiting good comprehension and analyzing skills
- CO2 Participate effectively in formal group discussions and prepare professional e mails, persuasive and expository paragraphs to establish and meet organizational needs and goals.
- **CO3** Fare well in IELTS and other English language assessment segments of competitive examinations within the stipulated time.
- **CO4** Write effective résumés, and face interviews with communicative competence and confidence, with a good knowledge of career skills.
- **CO5** Select appropriate vocabulary and idiomatic expressions, identify errors in syntax, and arrange sentences to make meaningful paragraphs, without any aid.

Page 104

Communication Skill is a life skill necessary for all students of Engineering and Technology. The course Communicative Skills Laboratory aims at developing effective oral and written communication to facilitate their success in competitive examinations, and recruitment screening thereby ensuring professional success

(Fifth / Sixth Semester)

22MCL06 Preamble :

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22MDT61

Pre-requisites : Nil

Preamble

Medical image processing provides an introduction to the basic concepts of image processing methods and to acquire knowledge of processing of digital and medical images using various transformation techniques. It provides students to realize about different filters and to develop algorithms for image processing .In order to understand the analysis of entire image in frequency domain it is essential to learn the various image transforms. Also, it is necessary to learn the concepts of image enhancement, segmentation and compression.

UNIT 1 DIGITAL IMAGE FUNDAMENTALS

Steps in Digital Image Processing - Components - Elements of Visual Perception - Image Sensing and Acquisition -Image Sampling and Quantization - Relationships between pixels - Color image fundamentals - RGB, 2Dtransforms- DFT, DCT.

UNIT 2 IMAGE ENHANCEMENT

Spatial Domain: Gray level transformations - Histogram processing - Histogram equalization to Mammographic images. 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, Homomorphic filtering approach to X-ray images.

UNIT 3 IMAGE RESTORATION

Image Restoration - degradation model, Properties, Noise models - Mean Filters - Order Statistics -Adaptive filters - Band reject Filters - Band pass Filters - Notch Filters - Optimum Notch Filtering -Medical Image Restoration-Inverse Filtering – Wiener filtering.

UNIT 4 IMAGE SEGMENTATION AND REPRESENTATION

Detection of discontinuities-Point, Line and Edge detection-Gradient operators-Edge linking via Hough transform - Thresholding - Region based segmentation - Region growing - Region splitting and merging. Boundary representation-chain codes-polygonal approximation-Breast Tissue detection-Analysis of Tissue structure.

UNIT 5 IMAGE COMPRESSION AND RECOGNITION

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Texture - Patterns and Pattern classes - Recognition based on matching. Content Based Medical Image Retrieval.

TEXT BOOKS:

- Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 4thEdition, 2017. 1.
- 2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 4 th Edition, 2002.

REFERENCES:

- Kenneth R. Castleman, "Digital Image Processing", Pearson, 2nd Edition, 2006. 1.
- 2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2nd Edition, 2011.
- 3. Wolfgang Birkfellner, "Applied Medical Image Processing: A Basic Course", Taylor & Francis, 2nd Edition,2016.

e-Resources:

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Total: 45 Periods

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- 1. NPTEL Video https://nptel.ac.in/courses/117105079/ "Introduction to Digital Image Processing",Prof.Prabir Kumar Biswas, IIT Kharagpur.
- 2. NPTEL Video https://www.digimat.in/nptel/courses/video/108105091/L01.html" Introduction to Medical Image Analysis", Prof.Debdoot Sheet, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Infer the digital image using sampling and quantization techniques.
- CO2 Analyze the enhanced image by spatial domain and frequency domain methods.
- CO3 Analyse and restore the enhanced images using inverse and weiner filtering.
- CO4 Contrast the given image discontinuities by point, line and edge detection and segment the given CO4 image by thresholding and represent the boundary of images using chain codes and polygonal Approximation.
- CO5 Illustrate the compression techniques for the images using Huffman coding, Run Length coding, Predictive coding and Transform coding.

PO PSO PSO Cos/POs 1 2 3 4 5 6 7 8 9 10 11 12 1 2 **CO 1** 2 1 2 2 3 _ _ _ _ _ _ 1 _ _ **CO 2** 3 2 1 1 1 2 2 _ _ _ _ _ _ _ **CO 3** 3 2 2 2 1 1 2 _ _ _ _ _ _ _ **CO 4** 3 2 1 2 1 2 2 _ -_ _ _ _ _ **CO 5** 3 2 1 2 2 1 2

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDT62

REHABILITATION ENGINEERING

Pre-requisites : Nil

Preamble

This course aims to develop an understanding of the various rehabilitation aids so as to enable the student to design and apply them with confidence, to help the challenged people.

UNIT 1 INTRODUCTION TO REHABILITATION

Definitionof Rehabilitation: Types of Physical Impairments, Principles of Assistive Concept Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles- Key Ergonomic Principles- Engineering Concepts in Sensory & Motor rehabilitation.

UNIT 2 ORTHOPEDIC PROSTHETICS AND ORTHOTICS

Types of orthosis-FO,AFO,KAFO,HKAFO and prosthesis. Artificial limbs- body powered, externally powered and controlled orthotics and prosthetics, MyoElectric hand and arm prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

UNIT 3 MOBILITY AIDS

Electronic Travel Appliances (ETA): Path Sounder, Laser Cane, Sonic Guide. Wheel Chairs -Types, Materials used for wheel chairs-design of wheel Chair- Walking frames- Parallel bars- Tripods-Crutches. Virtual reality based rehabilitation- Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT 4 AUDITORY AND SPEECH ASSIST DEVICES

Types of deafness- hearing aids- application of DSP in hearing aids- Cochlear implants- Voice synthesizer- speech trainer.

UNIT 5 SENSORY AUGMENTATION AND SUBSTITUTIONS

Sensory augmentation and substitution- Visual system: Visual augmentation, Tactual vision substitution, and Auditory vision substitution. Auditory system- Auditory augmentation, visual auditory substitution, tactual auditory substitution. Tactual system - Tactual augmentation, Tactual substitution.

TEXT BOOKS:

- Joseph D.Bronzino, "The Biomedical Engineering Handbook", 4 th Edition: FourVolume Set, CRC 1. Press.2018.
- 2. Raymond V. Smith, "Rehabilitation Engineering", CRC press, Reprint 2018.

REFERENCES:

- Alex Mihailidis, Roger Smith, "Rehabilitation Engineering: Principles and Practice", CRC Press, 2022. 1.
- Xingdong Zhang, David Williams, "Definitions of Biomaterials for the Twenty-First Century", 2. Elsevier, 2019.
- 3. Joseph Webster, Douglas Murphy, "Atlas of Orthoses and Assistive Devices", Elsevier, 5 th Edition, 2017.
- 4. RoryACooper,"AnIntroductiontoRehabilitationEngineering", Taylor& Francis, CRCpress, 2006.

e-Resources:

- 1. https://swayam.gov.in/nd2_aic19_ge01/preview, "Development of Assistive technology for persons with Disabilities", Indumathi Rao, C B R Network.
- https://www.resna.org/Resources/Research-Guidelines "RESNA's Guidelines and Priorities for 2.

TOTAL : 45 PERIODS

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Assistive Technology and Rehabilitation Research".

Course Outcomes: Upon completion of this course, students will be able to:

- Summarize the key terminologies used by the rehabilitation team. CO1
- Design different orthotics and prosthetics for rehabilitation applications CO2
- Interpret the wheel chair technology and virtual reality tools as a mobility assist for challenged CO3 people.
- CO4 Illustrate the various assist devices for different disabilities of the body.
- CO5 Suggest augmented, substitute assistive devices for visually impaired persons.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 2	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 3	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 4	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 5	3	1	1	-	-	1	-	1	-	-	-	-	1	-
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Mapping of COs with POs and PSOs

3: Substantial (High) 1: Slight (Low) 2: Moderate (Medium) •-" No correlation **Preamble**

22MDT63

Pre-requisites : Nil

UNIT 1 INTRODUCTION

Introduction, Computers and bio statistical analysis, Introduction to probability, likelihood & odds, distribution variability. Finding the statistical distribution using appropriate software tool like R/ Python.

Healthcare analytics is used to analyzing data to assist in delivering optimal health care management and

UNIT 2 STATISTICAL PARAMETERS

Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing -single population proportion, difference between two population proportions, single population variance, tests of homogeneity. Testing of statistical parameters using appropriate software R / Python.

UNIT 3 REGRESSION AND CORRELATION ANALYSIS

Regression model, evaluating the regression equation, correlation model, correlation coefficient. Finding regression, correlation for the data using appropriate software like R / Python

UNIT 4 ANALYSIS OF VARIANCE

META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis, completely randomized design, randomized complete block design, repeated measures design, factorial experiment. Testing the variance using appropriate software tool like R / Python.

UNIT 5 CASE STUDIES

Epidemical reading and interpreting of epidemical studies, application in community health, Case study on Medical Imaging like MRI, CT. Case study on respiratory data, Case study on ECG data. Case study on COVID data, Software tools for data analytics.

TEXT BOOKS:

- Wayne W. Daniel, Biostatistics-A Foundation for Analysis in the Health Sciences, John Wiley & 1. Sons Publication, 10th Edition, 2013.
- Peter Armotage, Geoffrey Berry and J.N.S.Mathews, Statistical methods in Medical Research, 2. Wiley-Blackwell, 4th Edition, 2001.
- Bernard Rosner. Fundamentals of biostatistics. Nelson Education, 8th Edition 2015 ISBN:978-1-3. 305-26892-0

REFERENCES:

- Marcello Pagano and Kimberlee Gauvreu, Principles of Biostatistics, Chapman and Hall/CRC, 1. 2ndEdition, 2018.
- 2. Ronald N Forthofer and EunSul Lee, Introduction to Biostatistics, Academic Press, 1st Edition, 2014.

e-Resources:

- https://onlinecourses.nptel.ac.in/noc22_hs40/preview, "Exploring Survey Data on Health Care", 1. Prof. Pratap C. Mohanty, Dept of Humanities and social sciences, IIT Roorkee.
- 2. https://onlinecourses.nptel.ac.in/noc24 bt33/preview, "Biostatistics and Design of experiments", By Prof. Mukesh Doble, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

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TOTAL: 45 PERIODS

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- CO1 Understand the statistical methods for the design of biomedical research.
- CO2 Comprehend the fundamental of mathematical and statistical theory in the application of Healthcare.
- CO3 Apply the regression and correlation analyze in the healthcare data.
- CO4 Understand the Meta analysis and variance analysis.
- CO5 Interpret the results of the investigational methods.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	1	0	0	0	1	0	0	1	0
CO2	3	3	3	2	2	1	0	0	0	1	0	0	1	0
CO3	3	3	3	2	2	1	0	0	0	1	0	0	1	0
CO4	3	3	3	2	2	1	0	0	0	1	0	0	1	0
CO5	3	3	3	2	2	1	0	0	0	1	0	0	1	0

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDT64

MEDICAL CODING

L T P C 1 0 0 1

Pre-requisites : Anatomy and Human Physiology

Preamble

Clinical coders play an essential role in healthcare system by ensuring the quality and accuracy of important health data. This course fosters the knowledge needed to apply coding to medical information.

UNIT 1 INTRODUCTION

Medical Coding- Coding systems- CPT-ICD 10-HCPCS. Changing Face of Healthcare: Affordable Healthcare Act- Insurance Billing- Managed Care Health Plans- Health Maintenance Organizations. Impact of accurate medical coding on the healthcare system.

UNIT 2 MEDICAL CODING TERMINOLOGIES

Medical Terminology- Terminology – Root word, suffix, prefixes, combining forms. Terminology – Root word, suffix, prefixes, and combining forms. Cardiovascular system-Respiratory system.

UNIT 3 INTERNATIONAL CLASSIFICATION OF DISEASES

Introduction to ICD-9-CM- Overview of ICD 10-CM Layout- Steps to look up a diagnosis code-ICD-10-CM Official guidelines.

UNIT 4 CURRENT PROCEDURAL TERMINOLOGY

Introduction-Sequencing CPT Codes-CPT category II codes- Performance measurement-Category III Codes- Gidelines. HCPCS – Introduction- HCPCS Level II- Modifiers.

UNIT 5 CASE STUDIES

Cardiovascular System- Anatomy, Medical Terminology-ICD 10 CM Coding- CPT Coding- Modifiers-HCPCS.

Respiratory system.- Anatomy ,Medical Terminology-ICD 10 CM Coding- CPT Coding- Modifiers-HCPCS.

TEXT BOOKS:

- 1. 2023 Medical Coding Training: CPC® eBook; AAPC; AAPC publisher.
- 2. 2023 Medical Coding Training: Practical Application CPC, AAPC publisher.

REFERENCES:

- 1. AAPC, ICD-10-CM Code Book 2024.
- 2. HCPCS 2023 Level II Professional Edition (HCPCS Level II (American Medical Assn)).

e-Resources:

- 1. https://www.igmpi.ac.in/Certified-Medical-Coding-Professional-(CMCP).php, Academy of Medical Coders India.
- 2. https://www.aapc.com/resources/online-medical-coding-training-courses,AAPC.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Develop a deep understanding of key concepts.
- CO2 Analyze and understand medical terminologies.
- CO3 Interpret health care records and clinical documentation
- CO4 Describe a uniform nomenclature for coding medical procedures and services.
- CO5 Interpret basic to moderately clinical coding.

TOTAL: 15 PERIODS

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO2	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO3	3	2	1	1	-	-	-	1	-	1	-	-	-	-
CO4	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO5	3	2	1	1	-	-	-	1	-	1	-	-	1	-
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2: Moderate (Medium) 1: Slight (Low) 3: Substantial (High)

22MDL61

Pre-requisites:Nil

Preamble:

The Course enables the students to familiarize with the principles of processing medical signal and images to extract diagnostic information from them.

LIST OF EXPERIMENTS

1.Image arithmetic operations

- a. Addition
- b. Subtraction
- c. Multiplication
- d. Division of 2 images.
- 2. Medical Image Enhancement techniques
- a. Histogram
- b. Segmentation
- c Classification
- d. Enhancement
- e. Restoration.
- 3. Medical Image Segmentation- Edge detection, line detection and boundary detection.
- 4. Basic Morphological Operations.
- 5. Texture analysis with statistical properties.
- 6. Image classification / recognition of Medical Images
- 7. Medical image analysis using Python.
- 8. Image Enhancement using Python
- 9. Feature Detection using Python
- 10. Processing of Medical Images.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Determine the performance of basic arithmetic operations to biomedical images.
- 2. Develop and implement algorithms for image enhancement and restoration.
- 3. Analyze the enhanced image by spatial domain and frequency domain methods.
- 4. Analyze the medical image by morphological operation.
- 5. Develop programs for image segmentation and classification of retinal images to diagnose retinal Disorders.

TOTAL:45 PERIODS

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	-	-	-	-	1	1	-	1	
CO2	3	2	1	1	1	-	-	-	-	1	1	-	1	
CO3	3	2	1	1	1	-	-	-	-	1	1	-	1	
CO4	3	2	1	1	1	-	-	-	-	1	1	-	1	
CO5	3	2	1	1	1	-	-	-	-	1	1	-	1	

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDL62

MINI PROJECT

Pre-requisites : Nil

Preamble

This course develops the student's ability to solve a real time problem right from its identification and literature review till the successful solution of the same. It enables the students to work in a team and involve themselves in self-learning. It motivates the students to apply their innovation concepts and bring out market ready product. It trains the students in preparing project reports and to face reviews and viva voce examination.

Guidelines For Review And Evaluation

The students in a group of 2 to 4 work on a topic approved by the head of the department under the guidance of a faculty member and shall prepare a comprehensive mini project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report by internal examiner constituted by the Head of the Department.

Course Outcomes: Upon completion of this course, students will be able to:

Apply engineering fundamentals to analyze domain-specific issues to identify problem statements

CO1 with objectives and scope.

Investigate the identified problem and review state of the art literature surveys to synthesis CO2 system requirements.

Identify the risk/impact/technique and interpret the suitable standards related to the problem CO3 statement and design appropriate procedures/methods.

Develop modules using discipline specific tools and implement the modules to achieve valid CO4 conclusions.

Prepare documents related to their findings for a detailed presentation, defend the findings, andconclude with oral / written presentation.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO 2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO 3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO 4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO 5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

technology to the automation of tasks in healthcare industries. This course encompasses the broader goal

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

of creating intelligent healthcare systems.

UNIT 1 INTRODUCTION

22MDT71

Preamble

Pre-requisites : Nil

Artificial intelligence- Introduction-The Turing Test-Heuristics-Knowledge Representation-Expert Systems-Neural Computing. Major parts of AI-Fields and applications of AI-AI tools and Learning models- Python Libraries for AI- NumPy Library-Creating a random AI.

Machine learning and neural networks are pillars on to build intelligent applications. AI and ML technologies are increasingly shaping various aspects of lives, from the way of interaction with

UNIT 2 MACHINE LEARNING

Introduction-Types of Machine Learning-Machine learning algorithms-ML tasks- Feature Engineering, Selection, Extraction. Dimensionality Reduction - Working with Datasets-Cross validation-Regularization-Bias-variance Tradeoff-Metrics for Measuring models-Statistical Quantities.

UNIT 3 CLASSIFICATION AND REGRESSION

Data preparation-preprocessing the data, techniques for preprocessing. Supervised learning-Classification and Regression- Logistic regression, Decision tree classifiers, Random forest, Naïve Bayes, Support vector machine. Performance of classifiers- -Building classifier and regressors in python.

UNIT 4 NEURAL NETWORK AND FUZZY

Biological Neurons-Logical computations with neurons-Different learning rules-Types of activation Function-Perceptron model- Training algorithm, BPN algorithm.

UNIT 5 FUZZY IN MEDICINE

Fuzzy logic- concepts of fuzzy sets and classic sets -operations and properties- fuzzy logic control principles- Fuzzification, Defuzzification. Human disease diagnosis system using Fuzzy logic- Heart disease diagnosis system using Fuzzy system. Overview of CNN.

TEXT BOOKS:

- Stuart Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", Fourth Edition, 1. Pearson Education, 2021.
- Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020 2.

REFERENCES:

- Zsolt Nagy, "Artificial Intelligence and Machine Learning Fundamentals", Packt Publishing, 2018. 1.
- Oswald Campesato, "Artificial Intelligence, Machine Learning, and Deep Learning", Mercury Learning and Information, 2020. 2.
- Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007 3.
- 4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

e-Resources:

- 1. https://nptel.ac.in/courses/106102220, "An Introduction to Artificial Intelligence", Prof. Mausam, IIT Delhi.
- https://archive.nptel.ac.in/courses/106/106/106106236/ "Introduction to Machine Learning", Prof. 2. Arun Rajkumar, IIT Madras.

TOTAL: 45 PERIODS

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Implement AI algorithms in Python.
- CO2 Illustrate various machine learning tasks to prepare a dataset and perform training process.
- CO3 Interpret regression and classification using python to real world problems.
- CO4 Discuss the fundamentals of neural networks for computations.
- CO5 Implement fuzzy logic for healthcare diagnosis system.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 2	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 3	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 4	3	1	1	-	-	1	-	1	-	-	-	-	1	-
CO 5	3	1	1	-	-	1	-	1	-	-	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-"]

22ITT71 ECONOMICS AND MANAGEMENT FOR ENGINEERS L T P C 3 0 0 3

Pre-requisites : -

Preamble

The main aim of this course is to understand the concepts of Economics with respect to the demand and supply analysis. This course makes the students to analyze the theory of production and the analysis of the cost parameter by using the Elasticity. This course will enable the students to manage and plan the situation with the help of the available strategies to support the decision making process.

UNIT 1 INTRODUCTION TO ECONOMICS

Introduction toEconomics – Scope of Economics – Positive and Normative Science – Methodology of Economics – Economic Laws - Economy and its basic problems: Economy and its working – Kindsof economy systems – Basic problems of economy.

UNIT 2 DEMAND AND SUPPLY ANALYSIS

The Law of Demand – The Law of Supply – Elasticities of Demand and Supply: Price Elasticity of Demand - Price Elasticity and Consumption Expenditure- Cross Elasticity of Demand – Income Elasticity of Demand – The Elasticity of Price Expectations – The uses of Elasticity– Price Elasticity of Supply.

UNIT 3 THEORY OF PRODUCTION AND ANALYSIS OF COST

Meaning of Production – Production concepts – Production Function – Laws of Production – Cost Concepts - Short-Run Cost Output Relations – Long Run Cost output relations – Economics of Scale

UNIT 4 INTRODUCTION TO MANAGEMENT

Management: An Overview – Management Defined – Managerial skills – Managerial roles – Management responsibilities – Management functions. Evolution of Management: Classical approaches to Management – Contemporary Management Perspectives.

UNIT 5 PLANNING

Planning and Forecasting: Importance of Planning – Principles of effective Planning – Planning process – Types of Plans. Strategic Planning: Strategic Planning process – Rational decision making.

Total: 45 Periods

TEXT BOOKS:

- 1. D.N.Dwivedi, "Principles of Economics", Second Edition, Vikas Publishing House (P) Limited, NewDelhi, 2012.
- 2. J.S.Chandan, "Management Concepts and Strategies", Vikas Publishing House (P) Limited, NewDelhi, Reprint 2009.

REFERENCES:

- 1. Ranbir Singh," Principles of Engineering Economics and Management", S.K.Kataria& Sons, New Delhi, 2013.
- 2. Manish Varshney and Vidhan Banerjee, "Engineeringand Managerial Economics", First Edition, CBSPublishers and Distributors Pvt. Ltd., 2015.

e-RESOURCES:

- 1. http://nptel.ac.in/courses/110101005/, Prof.Trupti Mishra, S.J.M. School of Management, IITMumbai, Managerial Economics.
- 2. https://nptel.ac.in/courses/122106031/slides/3_1s.pdf, Dr.M.Thenmozhi, Professor, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

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- CO1 Explain how to use economics principles to solve economic problems in engineering disciplineby satisfying the economic laws.
- CO2 Discuss the demand and supply process for a market analysis using Price elasticity, Cross elasticity and Income elasticity.
- CO3 Interpret short run and long run costs in the process of production for carrying out a business.
- CO4 Apply managerial skills to make decisions and solve problems for achieving organizationalobjectives.
- CO5 Express the principles of effective planning for survival and success of all organizations usingstanding and single use planning methods.

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	2	1	1	-	1	-	-	-	-
CO2	2	3	2	2	-	2	1	1	-	1	-	-	-	-
CO3	2	3	2	2	-	2	1	1	-	1	-	-	-	-
CO4	2	3	2	2	-	2	1	1	-	1	-	-	-	-
CO5	2	3	2	2	-	2	1	1	-	1	-	-	-	-

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22HST71 HUMAN VALUES AND PROFESSIONAL ETHICS Т L

Pre-requisites: Universal Human Values

Preamble

Universal Human Values is a life skill necessary for all students of Engineering and Technology. The course aims to identify the values and skills, and to realize the need, basic guidelines, content and process of value education. Professional Ethics For Engineers deals with the human values, integrity and work ethics in the common world. This course is mainly concerned about the theories of ethics, which form the basis for the understanding and responsibility of the various groups encountered in Engineering.

UNIT 1 INTRODUCTION TO UNIVERSAL HUMAN VALUES

Understanding the need, basic guidelines, content and process for Value Education. Self Exploration-Mechanism for self-exploration. Continuous Happiness and Prosperity- Basic Human Aspirations and its requirements for fulfillment of Human Aspirations understanding and living in harmony at various levels

UNIT 2 HARMONY IN ONESELF, FAMILY AND SOCIETY

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding harmony in the Family- the basic unit of human Understanding values in human-human relationships. Trust and Respect- values of interaction. Difference between intention and competence. Difference between respect and relationship. differentiation

HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL UNIT 3 **ETHICS**

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics. Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models.

UNIT 4 ENGINEERING ETHICS

Senses of Engineering Ethics- Variety of moral issues - Types of inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and controversy - Models of professional roles -Professional responsibility - Moral reasoning - Theories about right action - Self-interest - Self respect - Duty ethics - Customs and religion.

UNIT 5 ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineers as responsible experimenters - Role of codes- Codes of Ethics - Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers (IETE) - A balanced outlook on law - Safe exits - The Bhopal gas tragedy and Challenger case study.

Lecture: 15, Total: 15

TEXT BOOKS:

- Gaur R R, Sangal R, Bagaria G P, "A Foundation Course in Human Values and Professional 1. Ethics". 3rd Revised Edition, 2023
- Govindarajan M, Natarajan S and Senthil Kumar V. S, "Engineering Ethics", PHI Learning Pvt. 2. Ltd, New Delhi, 2017.

REFERENCES:

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- 1. Banerjee B P, "Foundations of Ethics and Management", Excel Books. 2005.
- 2. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co., Lucknow. Reprinted 2008.
- 3. Subramanian R, "Professional Ethics", Oxford university press, 2017.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Relate the significance of value inputs in a classroom and start applying them in their life and profession.
- CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.
- CO3 Interpret the value of harmonious relationships based on the trust and respect in their life and profession.
- CO4 Discuss the ethical issues related to Engineering.
- CO5 Discuss Engineer's work in the context of its impact on society.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1						2	3	2	2			2		
CO 2						3		3	1			2		
CO 3						2	2	3	3	3		2		
CO 4	1	2				3		2				2		
CO 5	2	2	1			3	2	2				2		

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium),

3 - Substantial (High).

22MDL71MEDICAL ARTIFICIAL INTELLIGENCE LABORATORYL T P C
0 0 2 1

Pre-requisites: Nil

Preamble:

The Course enables the students to acquaint with various computing algorithms in Artificial Intelligence using software tools and understand the operation of basic elements in fuzzy logic and neural network through simulation to develop algorithms and solve problems in Healthcare.

LIST OF EXPERIMENTS

- 1. Develop and train an Artificial Neural Network using MATLAB.
- 2. Develop and train a Perceptron network to perform logical operations using MATLAB.
- 3. Build a simple NN model using MATLAB.
- 4. Development of neural network based application using Neural Networks toolbox
- 5. Development of fuzzy logic based applications using Fuzzy Logic toolbox
- 6. Construct a fuzzy inference system using GUI tools for a conditional decision making process
- 7. Expert system based heart disease diagnosis system.
- 8. Develop a deep learning model in python.
- 9. Develop a machine learning classifier for malignant and benign tumor prediction using python
- 10. Building Computer vision application using OpenCV package.

TOTAL:45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Build AI models using various computing tools.
- CO2 Demonstrate basic concepts of fuzzy logic and neural network through simulation
- CO3 Develop deep learning projects using various libraries.
- CO4 Create a medical disorder scenario and analyze the performance of expert system using any two tools to determine the decision making rate.
- CO5 Implement classification and prediction algorithms for diagnosis of medical disorder

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	1	1	-	-	-	-	1	1	-	-	1
CO2	3	2	-	1	1	-	-	-	-	1	1	-	-	1
CO3	3	2	-	1	1	-	-	-	-	1	1	-	-	1
CO4	3	2	-	1	1	-	-	-	-	1	1	-	-	1
CO5	3	2	-	1	1	-	-	-	-	1	1	-	-	1

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDL72

HOSPITAL TRAINING

Pre-requisites: Nil

Preamble:

To develop the practical experience at place where biomedical equipment's are utilized.

LIST OF EXPERIMENTS

- 1. Study of Ventilator functioning.
- 2. Study of Ultrasound machine.
- 3. Study of Heart Lung Model.
- 4. Troubleshooting, maintenance and servicing of medical equipments.
- 5. Presentation on various departments and equipments in the Hospital.

Students have to undergo two weeks practical training in hospitals with the prior approval from the Institution during semester holidays of that particular academic year. At the end of the training student willsubmit a report as per the prescribed format to the department.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Implement a patient-centered approach in healthcare
- 2. Communicate with other health professionals in a respectful and responsible manner
- 3. Demonstrate the maintenance and service of diagnostic and therapeutic equipments.
- 4. Propose a patient-centered inter-professional health improvement plan based upon the patient's perceivedneeds.
- 5. Demonstrate patient care in hospital setting and provide access to health care professionals to get a betterunderstanding of their work.

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO2	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO3	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO4	3	2	1	1	1	-	-	-	-	1	1	-	1	-
CO5	3	2	1	1	1	-	-	-	-	1	1	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

22MCT07 INDIAN CONSTITUTION AND TRADITIONAL KNOWLEDGE L T P C 2 0 00

Preamble: The course provides basic information on Indian Constitution and Indian Traditional knowledge. This is essential for all citizens and especially for engineers so that they become aware of Indian polity and governance. This also reminds the citizen about their obligation, adherence and upkeeping of Constitutional rights.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Outline the evolution of Indian constitution and Federal structure
- 2. List the functions of Centre, States and District Administrations
- 3. Elaborate the roles of Panchayati raj
- 4. Explain the powers and roles of Election Commission
- 5. Illustrate the Indian traditional knowledge and elucidate their recovery

UNIT 1

Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy - Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

UNIT 2

Governor: Role and Position, CM and Council of ministers, State Secretariat: organisation, Structure and Functions District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation,

UNIT 3

Panchayatraj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT 4

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

UNIT 5

Basic structure of Indian Knowledge System-Modern Science and Indian Knowledge – Philosophical Tradition - Indian Linguistic Tradition (Phonology, morphology, syntax and semantics) –Indian Artistic Tradition

TEXT BOOKS:TOTAL: 30 PERIODS

- 1. M.Rajaram, Indian Constitution, New Age International, 2009
- 2. V.Sivaramakrishnan (Ed.) Cultural Heritage of India (Course Material),BharatiyaVidyaBhavan, Mumbai. 5thEdition,2014

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Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Describe the emergence and evolution of Indian Constitution, structure and composition of Indian Constitution and federalism in the Indian context.
- CO2 List the functions of Centre, States and District Administrations, Fundamental rights needed to develop human personality in free society.
- CO3 Identify different levels of Panchayat Raj system and its working.
- CO4 Elaborate the role of Election Commission and its power to conduct free and fair election throughout India.
- CO5 Develop a broad understanding of Indian society and intercultural literacy through cultural immersion.

CO – PO Mapping:

Course	РО	РО	PO	PSO	PSO									
outcome	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3	2	2	2	2		2		
CO2						3	2	2	2	2		2		
CO3						3	2	2	2	2		2		
CO4						3	2	2	2	2		2		
CO5						3	2	2	2	2		2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

22MDL81

INTERNSHIP

Preamble

This course enables off-campus experiential learning activities designed to provide students with opportunities in healthcare to make connections between the theory and practice of academic study and the practical application of that study in a professional work environment.

Course Outcomes: Upon completion of the course, students will be able to:

1. Identify the significance of the selected field of study and define the problem systematically.

2. Acquire practical knowledge to formulate objectives, methodology of the study.

3. Exhibit evidence of increased content knowledge gained through practical experience.

4. Apply the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.

5. Report the findings of the study and present their views in the form of suggestions to overcome the selected problem.

GUIDELINES FOR REVIEW AND EVALUATION:

The students work on a topic approved by the head of the department under the guidance of a faculty member and shall prepare a comprehensive internship report after completing the work to the satisfaction of the organization. The progress of the intern is evaluated based on reviews. The review committee may be constituted by the Head of the Department. An intern report is required at the end of the semester.

22MDL82

Pre-requisites : Nil

Preamble

This course enables the students develop the ability to solve a real time problem as a medical electronics engineer right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

Guidelines For Review And Evaluation

The students in a group of 2 to 4 work on a topic approved by the head of the department under the guidance of a faculty member and shall prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Identify inherent potential research areas in the field of healthcare.
- CO2 Compare and contrast the state of art techniques and solutions for the real-time issues identified.
- CO3 Formulate and propose a proper methodology by creating a solution for the research plan identified.
- CO4 Conduct the experiments as a team and interpret the results.
- CO5 Report the documents related to their findings for detailed presentations, defend the findings and conclude with oral/written presentation.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO 2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO 3	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO 4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO 5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

COMMUNICATION SYSTEMS

С L Т Р 3 0 3 0

Pre-requisites : Nil

Preamble

This course aims at designing Analog and Digital communication systems that are used for the transmission of information. A detailed quantitative framework for analog and digital transmission techniques is addressed.

UNIT 1 ANALOG COMMUNICATION

Introduction to Communication Systems: Modulation - Types - Need for Modulation - Amplitude Modulation - Evolution and Description of SSB Techniques - Frequency and Phase Modulation: Relationship between FM and PM- FM Transmitters: Direct and Indirect method - FM Receiver -Comparison of various Analog Communication Systems (AM – FM – PM).

UNIT 2 DIGITAL COMMUNICATION

Amplitude Shift Keying (ASK) - Frequency Shift Keying (FSK) - Phase Shift Keying (PSK) -Quadrature Amplitude Modulation (QAM) – 8 QAM - 16 QAM - Comparison of various Digital Communication Systems (ASK – FSK – PSK – QAM).

UNIT 3 DATA AND PULSE COMMUNICATION

Data Communication: Standards Organizations for Data Communication - Data Communication Circuits- Error Detection and Correction Techniques - Data communication Hardware.

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).

UNIT 4 SOURCE AND ERROR CONTROL CODING

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes.

UNIT 5 MULTI-USER RADIO COMMUNICATION

Global System for Mobile Communications (GSM) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand off - Satellite Communication: Kepler's Law - satellite orbit - Geostationary Satellite – Satellite link modes – Bluetooth – Wi Fi – 5G.

TEXT BOOKS:

- Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Ed, Pearson Education, 1. 2009.
- B.P.Lathi,", "Modern Digital and Analog Communication Systems", 4th Ed, Oxford University, 2. 2011.
- 3. Haykin,", "Digital Communications Systems", 4th Ed, Wiley, 2013.

REFERENCES:

- H.Taub, D L Schilling and G Saha, "Principles of Communication", 4th Edition, McGraw Hill 1. Education, 2017
- Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2006 2.
- Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson 3. Education, 2010.

e-Resources:

http://nptel.ac.in/courses/ 117101051 /, "Quantization, PCM and Delta Modulation", Prof. Bikash 1. Kumar Dey, IIT, Bombay.

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TOTAL : 45 PERIODS

- http://nptel.ac.in/courses/ 117101051 /, "Source Coding (Part 1)", Prof. Bikash Kumar Dey, IIT, Bombay.
- 3. http://nptel.ac.in/courses/ 117101051 /, "Introduction to Digital Communication)", Prof. Bikash Kumar Dey, III, Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Evaluate the AM, FM and PM systems with respect to performance and signal to noise ratio.
- CO2 Compare the performance of various shift keying techniques used in digital communication systems
- CO3 Analyze the characteristics of PAM, PTM and PCM modulation techniques and evaluate natural and flat top sampling techniques in digital pulse modulation
- CO4 Compare and contrast of Huffman and Shannon-Fano coding techniques for coding efficiency of lossless data compression
- CO5 Summarize the basic physical and technical settings of mobile communication systems and illustrate the orbital parameters of a satellite.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 2	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 3	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 4	3	2	1	1	1	-	-	1	-	1	-	-	1	-
CO 5	3	2	1	1	1	-	-	1	-	1	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

PYTHON PROGRAMMING LABORATORY (Common to all B.E, B.Tech Programmes)

((For the students admitted from AY2024- 25 onwards)

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.

(Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

- 2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points)
- 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
- Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
- Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
- 6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
- 7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
- 8. Implementation of searching algorithms using linear and binary search technique.
- 9. Implementation of sorting algorithms using selection sort and insertion sort method.
- 10. Implementing programs using written modules and Python Standard Libraries Libraries (pandas, numpy. Matplotlib, scipy)
- 11. Implementing real-time/technical applications using File handling.
- 12. Developing a game activity using Pygame like bouncing ball, car race.

SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

- CO1 Design flowcharts using Raptor.
- CO2 Develop programs using expressions and Control statements in Python.
- CO3 Develop programs using functions, packages for a given problem..
- CO4 Process compound data using Python data structures
- CO5 Utilize Python packages in developing software applications.

PO PO PO PSO PSO COs/POs **PO2** PO5 **PO7 PO8 PO9 PO1 PO3 PO4 PO6** 10 11 12 1 2 2 2 2 3 1 **CO1** -1 _ _ _ -_ -_ 2 1 2 2 3 1 **CO2** -_ _ _ _ _ _ _ 2 1 2 2 3 1 **CO3** -_ _ _ _ _ _ -**CO4** 2 2 2 3 -1 1 -------**CO5** 2 2 2 3 1 1 _ _

Mapping of COs with POs and PSOs

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

ENGLISH FOR PROFESSIONALS (III / IV Semester) (Students admitted during 2023-2024 onwards)

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology.	The
course Essential English for Professionals aims at enabling the learners to communicate effectively a	and
appropriately in professional contexts by exposing them to LSRW tasks.	
UNIT 1 LISTENING	5
Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing	
UNIT 2 READING	7
Reading for gist - Biographies of Famous Personalities - Reading and Note Making on News Articles	
UNIT 3 WRITING	5
Letter Writing - Seeking Permission- Seeking Apology - Letters Requesting Certificates – Analytical	
Writing and Issue based writing	
UNIT 4 SPEAKING	9
Presentation Techniques - Presentation with visual aids – Extempore and Impromptu talk	
UNIT 5 VERBAL ABILITY	4
Parajumbles - Sentence Completion - Identifying Common Errors	
TOTAL: 30 PERI	IODS

REFERENCES:

- 1. M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
- 2. Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1st Edition, New Delhi, 2008.

e. RESOURCES :

1. <u>https://agendaweb.org/listening/audio-books-mp3.html</u>

11.0

- 2. <u>https://www.ndtv.com/world-news</u>
- 3. <u>http://learnenglishteens.britishcouncil.org/skills/reading</u>
- 4. <u>https://www.bbc.com/</u>

Course Outcomes: Upon completion of the course, students will be able to:

- **CO1** Analyze the given listening material and answer the questions correctly employing listening techniques.
- **CO2** Analyze the given reading material and answer the questions correctly employing reading techniques.
- **CO3** Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.
- **CO4** Take part effectively in group discussion, conforming to professional norms and to give extemporaneous presentation.
- **CO5** Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

Cos/POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-
Mapping Average	-	-	-	-	3	-	-	-	3	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MDC41

SIGNAL PROCESSING IN HEALTHCARE

1

Pre-requisites : Nil

Preamble

This course concerns with analysis and synthesis of deterministic signals and their interaction with LTI systems. The analysis of Signals and its concepts play a vital role in signal processing, image and video processing and digital/analog communications. This course provides an introduction to the basic concepts of signal processing methods and to acquire knowledge of analysis of systems using various transformation techniques. It provides students to realize about different filter structure and also to develop algorithm for signal processing.

UNIT 1 CLASSIFICATION OF SIGNALS AND SYSTEMS

Continuous time signals - Discrete time signals - Impulse, Step, Ramp, Parabolic, Sinusoidal,

Exponential, Pulse -Operations on Signals - Classification of CT and DT signals: Deterministic & Random signals, Periodic & Aperiodic signals, Energy & Power signals, Causal & Non-causal, Even & Odd signals – CT systems and DT systems – Classification of systems: Static & Dynamic, Linear & nonlinear, Time-variant & Time invariant, Causal & non-causal, Stable & unstable.

UNIT 2 ANALYSIS OF CT AND DT SIGNALS

CT signal analysis - Fourier and Laplace Transforms, DT signal analysis - Z Transform - Inverse Z Transform (Partial fraction Method).

UNIT 3 DISCRETE AND FAST FOURIER TRANSFORM

Introduction to DFT – Efficient computation of DFT – FFT Algorithms: Decimation in Time FFT Algorithm - Decimation in Frequency FFT Algorithm – Convolution: Linear Convolution - Circular Convolution.

UNIT 4 DIGITAL FILTER DESIGN

IIR filter design: Analog filter design - Butterworth method - Impulse Invariance technique - Bilinear transformation technique - Realization structures: Direct form I - Direct form II. FIR filter design: Windowing techniques (Hamming Window, Hanning Window), Realization structures: Transversal and Linear phase structures.

UNIT 5 DSP APPLICATIONS IN HEALTHCARE

Introduction to Multirate Signal Processing – Decimation – Interpolation – Adaptive Filters: Introduction – Applications of adaptive filtering to equalization- Healthcare applications.

LIST OF EXPERIMENTS:

- Generation of elementary Discrete-Time sequences. 1.
- Fast Fourier Transform. 2.
- 3. Design of IIR Butterworth filter using bilinear transformation method.
- 4. Design of FIR filter using windowing techniques.
- 5. Simulation of up sampling and down sampling.

TOTAL (L:45+P:15): 60 PERIODS

TEXT BOOKS:

- 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, India, Second Edition, reprint, 2015.
- 2. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Pearson Education / Prentice Hall, Fourth Edition, 2007.

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REFERENCES:

- 1. P. Ramesh Babu and R.Anandanatarajan, "Signals and Systems", Scitech Publication, 2014.
- 2. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
- 3. Sanjit K. Mitra, "Digital Signal Processing - A Computer Based Approach", McGraw Hill, 4th edition 2013.
- Emmanuel C.Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Pearson Education / Prentice 4. Hall, Second Edition, 2002.

e-Resources:

- http://www.nptel.in/courses/117101055, "Signals and systems", Prof.V.M.Gadre, IIT Bombay. 1.
- http://www.nptelvideos.in/2012/12/digital-signal-processing.html, "Digital Signal Processing", Prof. 2. S.C Dutta Roy, IIT Delhi
- 3. http://www.nptelvideos.in/2012/11/digital-signal-processing.html, "Digital Signal Processing", Prof.T.K.Basu, IIT Kharagpur
- Course Outcomes: Upon completion of this course, students will be able to:
- Verify the linearity, stability, causality and time invariance properties of CT and DT systems. CO1
- Compute the frequency spectrum of the periodic CT signals using Fourier series and aperiodic CT CO2 signals using Fourier & Laplace transforms.
- Compute the DFT of the discrete time sequence to determine the frequency spectrum by using FFT CO3 algorithms.
- Design digital IIR and FIR filters from the analog specifications by applying various techniques. CO4
- CO5 Describe the multiple sampling rate conversion process by a suitable rational factor.

COs/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	1	-	1	-	1	-	-
CO 2	3	2	1	1	1	-	-	1	-	1	-	1	-	-
CO 3	3	2	1	1	1	-	-	1	-	1	-	1	-	-
CO 4	3	2	1	1	1	-	-	1	-	1	-	1	1	-
CO 5	3	2	1	1	1	-	-	1	-	1	-	1	1	-
1. Slight (Low) 2. Moderate (Medium))	3. Sui	hstanti	al (Hi	"-" No correlation					

Mapping of COs with POs and PSOs

1: Sugni (Low)

2: Moaerale (Mealum)

5: Substantial (Hign)

No correlation

22MDO01

Pre-requisites : Nil

Preamble

Medical Electronics concerned with describing the application of technological methods to medical diagnosis and therapy. Tremendous increase in use of modern medical equipment in hospitals, research institutes has made every engineer to understand the design and functioning of various medical equipments. The courses will focus strongly on the medical assist devices, diagnosis and therapeutic equipments suitable to deliver quality patient care in hospitals and laboratories.

UNIT 1 MEDICAL ELECTRONICS-AN OVERVIEW

Introduction – Design of Medical Instruments – Block diagram of generalized Medical Instruments Systems –Components of Medical Instruments – Electrodes – Types of Electrodes – Micro Electrodes-Depth and needle Electrodes – Surface Electrodes –Distortion in the measured Bioelectric Signals using electrodes.

UNIT 2 BIOSIGNAL ACQUISITION AND RECORDERS

Biosignal Acquisition – Medical Preamplifier design (Instrumentation Amplifier)–ECG Isolation Amplifier Circuit – Signal recovery and Data acquisition –Biopotential Recorders – Characteristics of the Recording System – ECG, EEG–typical waveform and Signal Characteristics.

UNIT 3 MEDICAL ASSIST DEVICES

Introduction– Pacemakers – Energy requirements to excite heart muscle – Methods of stimulation – Artificial Heart valves–Defibrillators: AC and DC types – Heart Lung Machine (HLM) –Systematic Cardiovascular Circulation–Ventilators: Servo Controlled ventilators type.

UNIT 4 SPECIALISED MEDICAL EQUIPMENTS

Introduction –Blood Cell Counter – Digital Thermometer –Electronic thermometer – Automatic Bekesy audiometer –X-ray Machine – Image Intensifier in fluoroscopy.

UNIT 5 ADVANCEMENTS IN MEDICAL INSTRUMENTATION

Computers in medicine-digital computer -Cryogenic Surgery -Endoscopes -Endoscopic laser Coagulator-Computed Tomography -CT Scanner -MRI Instrumentation-Bio-feedback Instrumentation.

TEXT BOOKS:

- 1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, 4th Edition 2015.
- 2. Dr.M.Arumugam, "Biomedical Instrumentation", Anuradha Publishers, 2015.

REFERENCES:

- 1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson India, 2nd Edition 2022.
- 2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 4 th Edition, 2004.
- 3. R.D.Lele, "Computers in Medicine", Tata McGraw Hill, Second Reprint 2008.
- 3.

e-Resources:

- 1. <u>https://onlinecourses.swayam2.ac.in/nou23 bt05/preview</u>, "Biomedical Instrumentation & Sensors" By Dr. Piyush Lotia and Mr. Thaneshwar Kumar Sahu, Chhattisgarh Swami Vivekanand Technical University, Bhilai.
- 2. <u>https://www.everand.com/book/560994513/Introduction-to-Biomedical-Instrumentation-and-Its-</u>

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Total: 45 Periods

Applications

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Illustrate the factors required to design medical instruments with suitable requirements of the normal physiological system.
- CO2 Suggest an appropriate medical preamplifiers to improve the quality of biosignal acquisition in medical recorders and instruments.
- CO3 Differentiate the principle of pacemakers, Defibrillators, Heart-Lung machine to suggest a proper assist device for a patient in critical care.
- CO4 Identify and measure the chemical and radiation parameters to monitor patients in critical conditions.
- CO5 Interpret the novel methods of diagnosis and therapy in medical devices to improve patient care and quality.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	-	-	-	2	-	-	1	-	-	1	1	-
CO 2	3	1	-	-	-	2	-	-	1	-	-	1	1	-
CO 3	3	1	-	-	-	2	-	-	1	-	-	1	1	-
CO 4	3	1	-	-	-	2	-	-	1	-	-	1	1	-
CO 5	3	1	-	-	-	2	-	-	1	-	-	1	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDO02

Pre-requisites : Nil

Preamble

This course on Hospital Waste Management provides students with essential knowledge and skills for effectively managing waste generated in healthcare facilities. Through an exploration of waste types, disposal methods, and regulatory compliance, students will learn to mitigate health and environmental risks associated with biomedical waste. By the end of the course, students will be equipped to develop waste management plans, implement best practices, and contribute to the promotion of a safe and sustainable healthcare environment.

UNIT 1 BIOMEDICAL WASTE MANAGEMENT

Biomedical Waste Management – Types of Wastes – Major and Minor sources of biomedical waste – Categories and Classification of biomedical waste – Hazard of biomedical waste – Need for disposal of biomedical waste –Waste minimization –Waste Segregation and Labeling –Waste handling –Collection – Storage and Transportation –Treatment and disposal.

UNIT 2 DISPOSAL OF WASTE AND PRINCIPLES OF STERILIZATION

Disposal methods- Incinerator - Disease Transmission -Disinfection methods- Liquid waste Destruction-Landfill- Sterilization -Steam Sterilizing - Auto Claving.

UNIT 3 HAZARDOUS MATERIALS

Hazardous Materials-Hazardous substance safety -Osha Hazard Communication Standard -DOT Hazardous Material Regulations-Healthcare Hazardous Materials-Medical Gas System - Respiratory Protection.

UNIT 4 CONTROLS APPLIED TO WASTE MANAGEMENT

Healthcare Immunizations– Centers for Disease Control and Prevention – Disinfectants, Sterilants, and Antiseptics– OSHA Blood bore Pathogens Standard–Tuberculosis.

UNIT 5 ENVIRONMENTAL SAFETY, RISKS & PUBLIC ISSUES

Healthcare Opportunistic Infections –Facility Guidelines: Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention– Safety Signs, Colors and Marking Requirements – Environment issues in hospitals –Risk analysis

TEXT BOOKS:

- 1. Tweedy, James T., "Healthcare hazard control and safety management-CRC Press Taylor and Francis", Third Edition, 2022.
- 2. Anant preet Singh, Sukhjit Kaur, "Biomedical Waste Disposal", Jaypee Brothers Medical Publishers (P) Ltd, First Edition, 2012.
- 3. C.R. Brunner, "Medical Waste Disposable Handbook", Incinerated, Consultant in Corporated, Virginia, 2000.

REFERENCES:

- 1. Peter A. Reinhardt, "Infectious and Medical Waste Management", CRC Press, 2018.
- 2. Safe management of wastes from health-care activities, 2nd edition, World Health Organization 2014.

e-Resources:

1. <u>https://ihatepsm.com/blog/hospital-waste-management-bio-%E2%80%93-medical-waste-management</u>

Total : 45 Periods

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- <u>https://swayam.gov.in/nd2_cec20_ge13/preview</u>, "Solid and hazardous waste management", By Prof. V. K. Garg, Professor and Dean, School of Environment and Earth Sciences, Central University of Punjab, Bathinda.
- 3. <u>https://www.biomedicalwastesolutions.com/medical-waste-disposal/</u>

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Categorize various biomedical wastes based on their properties, facilitating proper handling, disposal, and regulatory compliance in healthcare settings.
- CO2 Describe the different methods used for waste disposal and basic principle of sterilization to avoid disease transmission
- CO3 Analyze various hazards standards, accidents and its control
- CO4 Understand the controls applied to waste management to prevent infectious diseases
- CO5 Interpret the healthcare opportunistic infections, implement safety guidelines, prevent accidents, and address hospital environmental issues through risk analysis and proactive measures

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	1	-	-	-	1	1	2	1	1	-	1	-	-
CO 2	2	1	-	-	-	1	1	2	1	1	-	1	-	-
CO 3	2	1	-	-	-	1	1	2	1	1	-	1	-	-
CO 4	2	1	-	-	-	1	1	2	1	1	-	1	-	-
CO 5	2	1	-	-	-	1	1	2	1	1	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Pre-requisites : Nil

Preamble

This course imparts knowledge on the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in adopted in hospitals data storage and retrieval. It also focuses on ICT applications to health care professionals where they frequently come across information systems for the support of patient care, assessment of quality of care, Medical research, decision-making, management and planning.

UNIT 1 HOSPITAL MANAGEMENT AND INFORMATION SYSTEM

HMIS-Introduction -Need -Benefits and capabilities of HMIS -Development of HMIS -Functional areas -Modules forming HMIS -Computerized Physician Order Entry System (CPOE) - HMIS and Internet-Integrated Information system.

UNIT 2 HIS MODULES

Hospital information system- Structure of HIS - Modules of HIS -Department Management -Organization charts -Department Workflow -Evaluation of department operation and services department equipment and supplies -Training and development.

UNIT 3 COMPUTER BASED PATIENT RECORDS AND CODES

Acute Care Records - Clinical Flow of Data- Clinical Data- Discharge Data Set -Coding-Nomenclature and Classification –General purpose code sets –Special Purpose code sets.

UNIT 4 RADIOLOGICAL INFORMATION SYSTEM

Radiological Information system- PACS- Components, Importing and Exporting images to PACS.RIS, MPI and other Text Systems, Integrating with other systems. DICOM, HL-7.

UNIT 5 HEALTH INFORMATION PROCESSING AND ISSUES

Health data quality - Post Discharge Processing - Electronic Health Record Management -Confidentiality and Compliance - Preparing a record for release -Internal request for information -Federal, corporate and facility compliance.

TEXT BOOKS:

- Nadinia A.Davis, Health Information Technology, Elsevier Health Sciences, (2014). 1.
- 2. Dinesh Bhatia, "Medical Informatics", PHI Learning Pvt. Ltd., 2015.

REFERENCES:

- Edward H. Shortliffe, Leslie E. Perreault, "Medical Informatics: Computer Applications in Health 1. Care and Biomedicine", Springer 2013.
- 2. Lele, Computers in Medicine Progress in Medical Informatics, Tata Ramachandra McGraw Hill Publishing Company, New Delhi, 2005.
- Alain Venot -Medical Informatics, e-Health, Fundamental and Applications, Springer-Verlag 3. Paris, 2013.

e-Resources:

- https://mobisoftinfotech.com/resources/blog/importance-of-health-information-system/ 1.
- https://www.dovepress.com/components-and-implementation-of-a-picture-archiving-and-2. communication-peer-reviewed-fulltext-article-RMI, " Components and implementation of a picture archiving and communication system in a prototype application", Hasan H Khaleel, Department of Medical Devices Techniques' Engineering, AL-Esraa University College

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Total: 45 Periods
Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Categorize different functional areas such as inpatient and outpatient areas to integrate the clinical work flow.
- CO2 Implement different modules of computerized system in hospital to support clinical activity.
- CO3 Identify and interpret the impact of computers on continuing medical education programmes to accelerate the knowledge base to patient care.
- CO4 Summarize and compare RIS, HIS and PACS.
- CO5 Illustrate the strategy of acquisition, processing and transformation of clinical data into information data to improve medical care.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	-	1	-	2	-	-	-	1	-	2	1	-
CO 2	2	3	-	1	-	2	-	-	-	1	-	2	1	-
CO 3	2	3	-	1	-	2	-	-	-	1	-	2	1	-
CO 4	2	3	-	1	-	2	-	-	-	1	-	2	1	-
CO 5	2	3	-	1	-	2	-	-	-	1	-	2	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

22MDO04

Pre-requisites : Nil

Preamble

This course focuses on recent advances in the Internet of Things (IoT) in biomedical and healthcare. Artificial intelligence and IoT are set to revolutionize all industries, but perhaps none so much as health care. Both biomedicine and machine learning applications are capable of analyzing data stored in national health databases in order to identify potential health problems, complications and effective protocols, and a range of wearable devices for biomedical and healthcare.

UNIT 1 BASICS OF HEALTHCARE IoT

Introduction- Healthcare architecture in Internet of Things-Communication between devices- Medical body area networks-Architecture Requirements- Healthcare Ecosystem- Health Care Applications using IoT- Health Application Requirements- Opportunities And Challenges.

UNIT 2 MEDICAL BIG DATA

Big Data dimensions Big Data for Medical Industry- Information Processing in Health Care Analytics-Data Mining Process for Medical Big Data- Medical Big Data Analytics- Medical Big Data-Applications and Challenges.

UNIT 3 IoT TECHNOLOGIES AND CHALLENGES

IoMT system Architecture- Components of system architecture- IoT Healthcare solutions- Enhanced medicine management- Technologies used in IoT-based applications.

UNIT 4 AI IN BIOMEDICINE

AI and Computer Vision in biomedicine-Principal Disciplines of AI and Computer Vision-Machine learning- Classification and Regression- Predictive Analysis. Biomedical applications and solutions-Medical Imaging-Pattern Recognition-Abnormality Detection.

UNIT 5 IoT IN HEALTHCARE APPLICATIONS

IoT based smart and secure health monitoring system- Development of obstacle avoiding robots based on sensors and IoT- Patient health monitoring system using Arduino and Android- detection of atrial fibrillation- fall detection using IoT technologies.

TEXT BOOKS:

- 1. Valentina E. Balas, Le Hoang Son, "Internet of Things in Biomedical Engineering", Academic Press,1 st Edition, 2019.
- Chinmay Chakraborty, Amit Banerjee, "Internet of Things for Healthcare Technologies", 2. Springer, 2021.
- Chintan Bhatt, Nilanjan Dey, "Internet of Things and Big Data Technologies for Next Generation 3. Healthcare", Springer- Technology & Engineering, 2017.

REFERENCES:

- Nilanjan Dey, Amira S. Ashour, "Wearable and Implantable Medical Devices: Applications and 1. Challenges", Academic Press,1 st Edition, 2019.
- Singh, Rajesh, Gehlot, Anita, Jain, Vishal, Malik, Handbook of Research on the Internet of Things 2. Applications in Robotics and Automation, IGI Global,1 st Edition, 2019.
- 3. Jamil Y. Khan, Mehmet R. Yuce, "Internet of Things (IoT): Systems and Applications", CRC Press, 1 st Edition, 2019.

e-Resources:

1. http://onlinecourses.nptel.ac.in/noc20_cs66/preview, "Introduction to Internet of things" Prof.

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Total: 45 Periods

SudipMisra, IIT Kharagpur.

2. NPTEL Videos <u>https://nptel.ac.in/courses/109/106/109106095/</u> "Health Research Fundamentals", Dr.Sanjay Mehendale, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Discuss IoT healthcare functional architecture and map its components with respect to requirement analysis and wearable characteristics.
- CO2 Summarize the process of medical big data analytics for diagnosis of abnormalities
- CO3 Compare the IoMT technologies associated with biomedicine and contrast working methodologies with respect to healthcare
- CO4 Illustrate artificial intelligence and computer vision techniques employed in biomedical sciences.
- CO5 Design and develop an IoT based health monitoring system using Arduino.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	3	1	-	-	1	-	-	-	1	-	1	-	-
CO 2	2	3	1	-	-	1	-	-	-	1	-	1	-	-
CO 3	2	3	1	-	-	1	-	-	-	1	-	1	-	-
CO 4	2	3	1	-	-	1	-	-	-	1	-	1	-	-
CO 5	2	3	1	-	-	1	-	-	-	1	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Pre-requisites : Nil

Preamble

The course enables the students to understand the basic concepts of human locomotion, biomechanical analysis using Finite Element Analysis and also provide knowledge on machines in haptics.

HAPTICS

UNIT 1 HUMAN HAPTICS

Somatosensory System, Motor System, Muscle Physiology; Haptic psycho physical experiments.

UNIT 2 MACHINE HAPTICS

Types of Haptic devices- Commonly used haptic devices – Phantom, Cyber grasp - Haptic devices design, Human factors involved.

UNIT 3 HAPTIC SENSORS AND ACTUATORS

Haptic sensors - Types of haptic sensors - Comparison - Working of haptic sensor technology - Haptic actuators - Types of haptic actuators - Comparison - Barriers in human haptic, Ergonomics.

UNIT 4 COMPUTATIONAL HAPTICS

Haptic rendering, Rigid bodies, Deformable bodies, Stability Rendering effects, Human performance and evaluation, Biomechanics of manipulation, Neuromuscular Models.

UNIT 5 HAPTICS FOR MEDICAL APPLICATIONS

Applications- Telemedicine; Rehabilitation, Medical Simulations for education.

TEXT BOOKS:

- 1. Kay M.Stanney, "Handbook of Virtual Environments: Design, Implementation, and Applications", Lawrence Erlbaum Associates, CRC Publications, 2nd Edition, 2014.
- 2. Abdulmotaleb El Saddik, "Haptics Rendering and Applications", Intech Publications, 2012.
- 3. Lynette A. Jones, "Haptics", MIT Press, Kindle edition, 2018.
- 4. Kandel, Eric R., et al., "Principles of neural science", Vol. 4, New York: McGraw-hill, 2000.

REFERENCES:

- 1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2012.
- 2. Nadim Maluf and Kirt Williams, "An introduction to Microelectro Mechancial Systems Engineering", Second Edition, Artech House Inc, MA, 2004.
- 3. Nitaigour Premch and Mahalik, "MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007.

e-Resources:

- 1. <u>http://www.digimat.in/nptel/courses/video/109107154/L07.html</u>, "Body Language: Key to Professional Success", Prof. Rashmi Gaur, IIT Roorkee.
- 2. <u>https://archive.nptel.ac.in/courses/121/106/121106013/</u>, "Virtual Reality Engineering", Prof.M. Manivannan, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the laws of principles of haptics for human
- CO2 Discuss the behavior of machines in haptics
- CO3 Analyze the suitable sensor and actuator for haptics
- CO4 Identify suitable computation for haptics
- CO5 Describe the finite element analysis, design the work station depending upon the haptics

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TOTAL: 45 PERIODS

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Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO 2	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO 3	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO 4	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO 5	3	1	1	1	1	-	-	-	-	-	-	-	1	-
1: Slight (Lo	w)	2: N	<i>Iodera</i>	te (Me	edium))	3: Sul	bstanti	al (Hi	gh)	" <u>"</u> " /	No cor	relation	!

22MDE12

MEDICAL OPTICS AND PHOTONICS

Pre-requisites : Nil

Preamble

The course enables the students to acquire knowledge on various applications of biosensors in medicine and learn the diagnostic, surgical and therapeutic applications of lasers in medicine.

UNIT 1 OPTICAL PROPERTIES

Basic principles of light - Reflection - Refraction - Absorption - Polarization - Interference - Coherence, Basic laws of light - Beer Lambert law - Snell's law, Optical properties of tissues - Absorption -Scattering - Anisotropy - Splicing.

UNIT 2 OPTICAL INSTRUMENTATION

Working principle of light sources - Lasers, Types of Lasers (CO2, Ruby, ND-YAG, Helium-Neon) - LEDs, Working principle of optical detectors - Photodiode - Spectrometer - CMOS and CCD cameras - Lens - Optical filters - Optical fibers.

UNIT 3 OPTICAL BIOSENSORS

Principles of Optical biosensing - Immobilization of bio-recognition elements, Types of optical biosensor - Fiber optic - Planar waveguide - Evanescent - Interferometric - Surface plasmon resonance - Advantages and disadvantages - Applications.

UNIT 4 LASER TISSUE INTERACTION

Laser tissue interactions via photochemical, Photothermal, Photomechanical techniques, Photodynamic therapy (PDT) - Oncological and non-oncological applications, Low Level Laser Therapy (LLLT) - Biostimulation applications.

UNIT 5 APPLICATIONS OF LASERS

Diagnostic - Optical coherence tomography, Fluorescence, Raman, Photoacoustic tomography, Laser induced breakdown spectroscopy (LIBS), Hyperspectral imaging. Surgical Lasers in dentistry, Dermatology, Ophthalmology, Applications.

TEXT BOOKS:

- 1. Tuan Vo Dinh, "Biomedical Photonics –Handbook", CRC Press, Bocaraton, 2014.
- 2. Shyamal Bhadra and Ajoy Ghatak, "Guided Wave Optics and Photonic Devices", 1st Edition, 2017.

REFERENCES:

- 1. Aaron H.-P. Ho, Donghyun Kim and Michael G. Somekh, "Handbook of Photonics for Biomedical Engineering" Living reference work, 2020.
- 2. Alexis Mendez, "Optics in Medicine", DOI: 10.1007/978-3-319-31903-2_13, 2016.
- 3. Amira Tandirovic Gursel, "Fiber Lasers and Their Medical Applications", DOI: 10.5772/intechopen.76610, 2018.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/127/105/127105225/</u>", "Biophotonics", Prof. Basudev Lahiri, IIT Kharagpur
- 2. <u>https://nobel-project.eu/technologies-in-medtech/photonics-for-healthcare/</u>
- Course Outcomes: Upon completion of this course, students will be able to:
- CO1 Explain the various physical properties of light and optical properties of tissues.
- CO2 Consolidate the working principles of optical components.
- CO3 Discuss the various applications of biosensors in medicine.

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Total: 45 Periods

- Summarize the diagnostic and surgical applications of lasers in medicine. CO4
- Explain the laser tissue interaction and various therapeutic applications of lasers. CO5

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	3	1	-	-	-	-	-	-	-	1	-	1
CO 2	3	2	3	1	-	-	-	-	-	-	-	1	-	1
CO 3	3	2	3	1	-	-	-	-	-	-	-	1	-	1
CO 4	3	2	3	1	-	-	-	-	-	-	-	1	-	1
CO 5	3	2	3	1	-	-	-	-	-	-	-	1	-	1
1: Slight (Lo	w)	2: N	Iodera	ate (Me	edium))	3: Sui	bstanti	al (Hig	gh)	"-" N	lo cor	relation	!

Mapping of COs with POs and PSOs

2: Moderate (Medium)

22MDE13

Pre-requisites : Nil

This course provides knowledge on the concepts of design and assembling of various parts and Study the process and material selection for UV and Laser based AM.

RAPID PROTOTYPING

UNIT 1 INTRODUCTION

Overview –Need -Development of Additive Manufacturing Technology -Principle – AM Process Chain-Classification –Rapid Prototyping-Rapid Tooling –Rapid Manufacturing – Applications - Benefits –Case studies, Overview of Bioprinting/Organ printing

UNIT 2 DESIGN FOR ADDITIVE MANUFACTURING

Design tools: Data processing -CAD model preparation –Part orientation and support structure generation –Model slicing –Tool path generation-Design for Additive Manufacturing: Concepts and objectives-AM unique capabilities –DFAM for part quality improvement-Customised design and fabrication for medical applications.

UNIT 3 PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES

Photo polymerization: SLA-Photo curable materials –Process -Advantages and Applications. Powder Bed Fusion: SLS-Process description –powder fusion mechanism –Process Parameters – Typical Materials and Application. Electron Beam Melting.

UNIT 4 EXTRUSION BASED AND SHEET LAMINATION PROCESSES

Extrusion Based System: FDM-Introduction –Basic Principle –Materials –Applications and Limitations – Bio extrusion. Sheet Lamination Process: LOM-Gluing or Adhesive bonding –Thermal bonding.

UNIT 5 PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES

Droplet formation technologies –Continuous mode –Drop on Demand mode –Three Dimensional Printing –Advantages –Bioplotter -Beam Deposition Process: LENS-Process description –Material delivery –Process parameters –Materials –Benefits –Applications

TEXT BOOKS:

- 1. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, World Scientific Publishers, Third edition, 2010.
- 2. Liou L.W. and Liou F.W., Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2007
- 3. Kamrani A.K. and Nasr E.A., Rapid Prototyping: Theory and practice, Springer, 2006.

REFERENCES:

- 1. Ian Gibson, David W.Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
- 2. Tom Page Design for Additive Manufacturing, LAP Lambert Academic Publishing, 2012.
- 3. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/108108115/,"</u>Physical Modelling for Electronics Enclosures using Rapid prototyping, Prof. N. V Chalapathi Rao, IISc Bangalore.
- 2. <u>https://digimat.in/nptel/courses/video/112104230/L38.html</u>,"Rapid Prototyping Processes Part 2",Dr,Amandeep singh,IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

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TOTAL : 45 PERIODS

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- CO1 Demonstrate the basics of Additive manufacturing
- Design and assembly of various parts for the desired task. CO2
- CO3 Explain the process involved in laser and UV based AM
- CO4 Illustrate the process of fused deposition molding and sheet lamination
- Support design and manufacturing, case studies relevant to mass customized manufacturing, and some of CO5 the important research challenges associated with AM and its data processing tools.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO 2	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO 3	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO 4	3	2	1	1	1	-	-	-	-	-	-	1	-	-
CO 5	3	2	1	1	1	-	-	-	-	-	-	1	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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Pre-requisites : Nil

Preamble

The course enables the students to get exposed to principles of visual capabilities, learn the mechanics of muscle physiology and spatial compatibility. Also to get familiar with the mathematical models, analysis and design of biomedical devices using case studies.

UNIT 1 VISUAL AND AUDITORY ERGONOMICS

Process of seeing – visual capabilities – factors affecting visual acuity and contrast sensitivity – human factor aspects of hard copy text and computer screen text, factors in selecting graphic representations symbols, qualitative visual display – process of hearing – principles of auditory display. Measures for monitoring control & mitigation.

UNIT 2 MUSCLE PHYSIOLOGY

Muscle physiology – muscle metabolism – respiratory response – joint motion study – measure of physiological in-efficiency and energy consumption – work rest cycles – aspects of manual and posture study, material handling (MMH) Bio-mechanical recommended limits of MMH.

UNIT 3 CONTROLS AND DISPLAYS

Spatial compatibility and physical arrangement of displays and controls - Design of displays and controls - movement capability - rotary controls and rotor displays movement of displays orientation of the operator and movement relationships control orders and control responses - human limitations in tracking task

UNIT 4 ANTHROPOMETRY

Anthropometry – anthropometric design principles – Physical work load and energy expenditure - work space envelope – factors in design of work space surfaces – principles of seat design – principles of control panel. ergonomic implications. Organization classification of human errors theories of accident causation-reducing accidents by altering behavior

UNIT 5 CASE STUDIES

Case Study 1: computer design, control panel design of an electronic instrument, computer key board, hand drill etc.

Case Study 2: Biomedical Application, Design optimization of Medical Equipment.

TEXT BOOKS:

- 1. Pascale Carayon, "Handbook of Human Factors and Engineering", Second Edition, CRC Press, 2020
- 2. Martin Helander, "Guide to Human Factors and Ergonomics", Second Edition, CRC Press, 2016
- 3. Benjamin W. Niebel, "Motion and Time Study", Richard, D. Irwin Inc., Seventh Edition, 2019

REFERENCES:

- 1. Shrawan Kumar, "Biomechanics in Ergonomics", Second Edition, CRC Press 2007.
- 2. George Kanawaty, "Introduction to work study", ILO, 3rd edition, Oxford & IBH publishing, 2011
- 3. Stephen Pheasant, Christine M. Haslegrave, Bodyspace: Anthropometry, Ergonomics and the Design of Work, CRC Press, 2005.

e-Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc24_bt05/preview</u>, "Human Physiology", By Prof. Nishikant Subedar.
- 2. https://archive.nptel.ac.in/courses/110/105/110105162/

Total: 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Comprehend and appreciate the significance and role of this course in the present contemporary world.
- CO2 Demonstrate knowledge of the fundamentals of optical properties of tissues.
- CO3 Describe surgical applications of laser.
- CO4 Describe photonics and its therapeutic applications.
- CO5 Apply the concepts of laser and light to understand the laser safety procedures.

Mapping of COs with POs and PSOs

Cos/P	Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	l	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO	2	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO	3	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO	1	3	1	1	1	1	-	-	-	-	-	-	-	1	-
CO	5	3	1	1	1	1	-	-	-	-	-	-	-	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

AI IN HEALTHCARE

Pre-requisites : Nil

Preamble

The course makes the students to learn about the knowledge representation in solving AI problems and to acquire knowledge on implementing and planning Machine learning algorithms.

UNIT 1 INTRODUCTION TO AL AND PRODUCTION SYSTEMS

Introduction to AI-Problem formulation, Problem Definition-Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized production system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.

UNIT 2 REPRESENTATION OF KNOWLEDGE

Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

UNIT 3 KNOWLEDGE INFERENCE

Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network- Dempster – Shafer theory.

UNIT 4 PLANNING AND MACHINE LEARNING

Basic plan generation systems – Strips - Advanced plan generation systems – K strips – Strategic Explanations-Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

UNIT 5 EXPERT SYSTEMS

Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

Total : 45 Periods

TEXT BOOKS:

- 1. Stuart Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", Fourth Edition, Pearson Education, 2022.
- 2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES:

- 1. Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education, Sixth Reprint, 2019.
- 2. Stuart Russel and Peter Norvig "AI A Modern Approach", 4th Edition, Pearson Education, 2022.
- 3. Prof. Vishwajit K. Barbudhe, "Introduction to Artificial Intelligence & Expert Systems", 1st Edition, Universe Win Publication House and Research Services Pvt Ltd, 2020.

e-Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc22_cs83/preview</u>, "Applied Accelerated Artificial Intelligence", By Prof. Satyajit Das, Prof. Satyadhyan Chickerur, Prof. Bharatkumar Sharma.
- 2. <u>https://intellipaat.com/blog/artificial-intelligence-in-healthcare/</u>

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Discuss the basics of artificial intelligence and production systems
- CO2 Explain various methods of knowledge representation.

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- CO3 Discuss about knowledge inference techniques
- CO4 Illustrate the basics of machine learning and analysis of related algorithms
- CO5 Illustrate the basics of expert systems and perform analysis of algorithms related to expert systems

Cos/POs	PO 1	PO 2	PO 3	РО 4	РО 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	-	-	-	-	-	1	1	-	1	-	1
CO 2	3	2	1	-	-	-	-	-	1	1	-	1	-	1
CO 3	3	2	1	-	-	-	-	-	1	1	-	1	-	1
CO 4	3	2	1	-	-	-	-	-	1	1	-	1	-	1
CO 5	3	2	1	-	-	-	-	-	1	1	-	1	-	1

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

ROBOTICS AND AUTOMATION IN HEALTHCARE

Pre-requisites : Nil

Preamble

The course makes the students to understand the basic mechanism of robotic subsystems gain knowledge on design, analysis and working principle of robotics in medical field.

UNIT 1 INTRODUCTION OF ROBOTICS

Introduction to Robotics and its history, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Automation, Mechanisms and movements, Dynamic stabilization- Applications of robotics in medicine

UNIT 2 ACTUATORS AND GRIPPERS

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 3 MANIPULATORS & BASIC KINEMATICS

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems

UNIT 4 POWER SOURCES AND SENSORS

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 fiber optic and Tactile sensor

UNIT 5 ROBOTICS IN MEDICINE

Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric-, and General- Surgery, Gynecologic Surgery, General Surgery and Nano robotics.

Total : 45 Periods

TEXT BOOKS:

- 1. S. B. Niku, Introduction to Robotics, Analysis, Control, Applications, Pearson Education, 2020
- 2. Robert Schilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2009.

REFERENCES:

- 1. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications, 2017.
- 2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons, 1st Edition, 2015.
- 3. Grover, Wiess, Nagel and Oderey, Industrial Robotics, McGraw Hill, 2017.

e-Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc21_me49/preview</u> "Robotics and Control Theory and practice", Prof. N. Sukavanam, Prof.M.Felix Orlando, IIT Roorkee.
- 2. <u>https://link.springer.com/book/10.1007/978-3-030-79179-7</u>

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Outline the basic concept of robotics.
- CO2 Discuss about the sensors and actuators.
- CO3 Explain the working principle underlying in manipulators in robotics.
- CO4 Explain the working principle underlying in sensors with power source in robotics.
- CO5 Discuss the applications of robotic systems in medical field.

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Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	-	-	-	2	2	-	-	1	-
CO 2	3	2	1	1	-	-	-	-	2	2	-	-	1	-
CO 3	3	2	1	1	-	-	-	-	2	2	-	-	1	-
CO 4	3	2	1	1	-	-	-	-	2	2	-	-	1	-
CO 5	3	2	1	1	-	-	-	-	2	2	-	-	1	-
1: Slight (Lo	w)	2: N	Iodera	te (M	edium))	3: Sul	bstanti	al (Hi	gh)	"-" N	lo cor	relation	!

Preamble

The Course enables the students to know the application of Physiological models and vital organs.

UNIT 1 INTRODUCTION TO PHYSIOLOGICAL MODELING

Approaches to modelling: The technique of mathematical modelling, classification of models, characteristics of models. Time invariant and time varying systems for physiological modelling. Introduction to physiology (homeostasis, cell biology) Modelling physical systems, linear models of physiological systems, the Laplace transform, Transfer functions and block diagram analysis Physiology.

UNIT 2 COMPARTMENTENTAL PHYSIOLOGICAL MODEL

Modeling the body as compartments, behavior in simple compartmental system, pharmacokinetic model, and multi compartmental system. Physiological modelling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation. Mathematical modelling of the system: Thermo regulation, Thermoregulation of cold bloodedness& warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body.

UNIT 3 MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM

Dynamic systems and their control, modelling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open & close loop systems instability, automatic aperture control.

UNIT 4 SIMULATION OF PHYSIOLOGICAL SYSTEMS

Simulation of physiological systems using Open CV / MATLAB software. Biological receptors: - Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model.

UNIT 5 NONLINEAR MODELS OF PHYSIOLOGICAL SYSTEMS

Nonparametric Modelling-Volterra Models. Wiener Models. Efficient Volterra Kernel Estimation. Parametric Modelling - Basic Parametric Model Forms and Estimation Procedures- Volterra Kernels of Nonlinear Differential Equations. Discrete-Time Volterra Kernels of NARMAX Models.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Michel C Khoo, "Physiological Control Systems -Analysis, simulation and estimation", Prentice Hall of India, 2018.
- 2. Marmarelis, "Nonlinear Dynamic Modeling of Physiological Systems", Wiley-IEEE Press, 2014.

REFERENCES:

- 1. Benjamin C Kuo, "Automatic control systems", Tenth Edition, McGraw-Hill Education, 2017.
- 2. MinruiFei, Shiwei Ma, Xin Li, Xin Sun, Li Jia and Zhou Su," Advanced Computational Methods in Life System Modeling and Simulation", Springer,2017

e-Resources:

- 1. <u>https://archive.nptel.ac.in/courses/112/107/112107214/</u>, "Modelling and Simulation of Dynamic systems", Dr. Pushparaj Mani Pathak, IIT Roorkee.
- 2. <u>https://archive.nptel.ac.in/courses/108/106/108106085/</u>,"Introduction to Non Linear Dynamics", Dr. Shane Ross, IIT Kanpur.

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 To explain the application of Physiological models and vital organs
- CO2 To Formulate the methods and techniques for analysis and synthesis of dynamic models
- CO3 To describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.
- CO4 To describe nonlinear models of physiological systems
- CO5 To compute the Simulation of physiological systems

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	1	1	-	-		-	-	-	-	-	-
CO 2	3	1	1	1	1	-	-		-	-	-	-	-	-
CO 3	3	1	1	1	1	-	-		-	-	-	-	-	-
CO 4	3	1	1	1	1	-	-		-	-	-	-	-	-
CO 5	3	1	1	1	1	-	-		-	-	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

MEDICAL DEVICE DESIGN

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Pre-requisites : Nil

Preamble

22MDE21

Medical device design provides an introduction to the basic concepts of image finding generation and to acquire knowledge of processing of digital and medical images using various transformation techniques. It provides students to realize about different analysis and to develop algorithms for image processing. In order to understand the analysis of entire image in frequency domain it is essential to learn the various image transforms. Also, it is necessary to learn the concepts of image testing, validation design transfer and manufacturing.

UNIT 1 NEEDS FINDING AND CONCEPT GENERATION

Strategic Focus – observation and problem identification – Need statement development. Ideation and Brainstorming – concept screening, concept selection: intellectual property basics – reimbursement basics – business models – prototyping – final concept selection. Safety and Risk Management - Tools, Documents and Deliverables.

UNIT 2 MEDICAL DEVICES STANDARDS AND REQUIREMENTS

FDA, Medical devices classification, Medical Devices Directive Process – Harmonized Standards, ISO13485, ISO 14971, IEC60601-1, IEC 62304. Reliability, Concept of failure, Product Design and Development Process.

UNIT 3 DESIGN ENGINEERING

Hardware Design, Hardware Risk Analysis, Design and Project Metrics, Design for Six Sigma, Software Design, Software Coding, Software Risk Analysis, Software Metrics.

UNIT 4 TESTING AND VALIDATION

Basis and Types of Testing, Hardware Verification and Data Analysis, Software Verification and Data Analysis.

UNIT 5 DESIGN TRANSFER AND MANUFACTURING

Transfer to Manufacturing, Hardware Manufacturing, Software Manufacturing, Approval from Regulatory Bodies, Configuration Management, Intellectual Property-Copy Rights-Trademarks-Trade Secrets, Case study.

TEXT BOOKS:

- 1. Peter Ogrodnik, Medical Device Design Innovation from Concept to Market, Elsevier, 2013
- 2. Zenios, Makower and Yock, —Biodesign The process of innovating medical technologiesl, Canbridge University Press, 2009
- 3. Theodore R. Kucklick , The Medical Device R&D Handbook, Second Edition, CRC Press, 2012.

REFERENCES:

- 1. Matthew Bret Weinger, Michael E. Wiklund, Daryle Jean Gardner-Bonneau'Handbook of Human Factors in Medical Device Design',CRC press,2010.
- 2. Gail Baura, Medical Device Technologies: A Systems Based Overview Using Engineering, Elsevier science, 2012.
- 3. Jagdish Chaturvedi, Inventing medical devices: A perspective from India, Create Space Independent Publishing Platform, 1st edition, 2015.

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TOTAL : 45 PERIODS

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e-Resources:

- 1. <u>https://www.digimat.in/nptel/courses/video/127106010/L11.html</u>, "NOC:Regulatory Requirements for Medical Devices and IVD kits in India, IIT Bombay.
- 2. <u>https://onlinecourses.nptel.ac.in/noc21_de12/preview</u>, "Introduce Engineering Design as a structured process, different from the Conventional Design Engineering., IIT-Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Define the medical devices standards and requirements.
- CO2 Summarize the concept of medical device development.
- CO3 Recall the engineering design and project metrics.
- CO4 Demonstrate the testing and validation of medical equipment.
- CO5 Interpret the various design transfer and manufacturing methods.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	-	-	1	-	-	-	-
CO 2	3	2	1	1	1	-	-	-	-	1	-	-	-	-
CO 3	3	2	1	1	1	-	-	1	1	1	-	-	-	-
CO 4	3	2	1	1	1	-	-	1	1	1	-	-	-	-
CO 5	3	2	1	1	1	-	-	1	1	1	-	-	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDE22

Preamble

engineering.

Pre-requisites : Nil

Introduction - Static bending of Thin plates- Mechanical vibration- resonant vibration- Thermo mechanics- Thermal Effects on mechanical strength of materials- creep deformation- Thermal stresses. Fracture Mechanics- Thin Film mechanics- equations in continuum fluid dynamics- computational fluid dynamics- Incompressible fluid flow in microconduits.

UNIT 3 MATERIALS FOR MINIATURIZATION

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS

system design and fabrication- Ion and Ionization- Electrochemistry.

UNIT 2 MICROSYSTEMS AND THERMO FLUID ENGINEERING

Substrates and wafers- active substrate materials- Silicon substrate material- Silicon compoundssilicon piezoresistors- gallium arsenide- quartz- piezoelectric crystals- Polymers for MEMS and Microsystems- conductive polymers- Langmuir - Boldgent film- Laws for miniaturization- Scalinggeometry- rigid body dynamics- electrostatic forces- electromagnetic forces- electricity- fluid mechanics-heat transfer.

UNIT 4 MICROSYSTEM FABRICATION AND MICRO MANUFACTURING

Photolithography- ion implantation- diffusion- oxidation. Vapor deposition - physical and chemicalsputtering- etching- chemical etching and plasma etching. Bulk micro manufacturing surface micro machining-LIGA process-SLIGA process.

UNIT 5 MICROSYSTEM PACKAGING

Design of micro fluidic network systems- design constraints and selection of materials. Packaging of microelectronics- microsystem packaging- interfaces- three dimensional packaging- assembly of micro systems. Pressure sensor packaging, Lab On Chip, Organ On Chip.

TOTAL : 45 PERIODS

TEXT BOOKS:

- Tai- Ran Hsu "MEMS & Microsystems design and manufacture"- Tata McGraw- Hill, New Delhi, 2017. 1.
- 2. Samira Hosseini, Michelle Alejandra Espinosa-Hernandez, "BioMEMS- Biosensing Applications", Springer Nature, 2020.

REFERENCES:

- Wanjun Wang and Steven A.Soper "Bio- MEMS technologies and applications", CRC Press, 1 st 1. Edition,2007
- P.Rai- Choudhury " MEMS and MOEMS Technology and Applications", PHI Learning , New 2. delhi, 2000.
- Alok Pandya, Vijai Singh, Micro/Nanofluidics and Lab-on-Chip Based Emerging Technologies for 3. Biomedical and Translational Research Applications - Part B, Academic Press, 2022
- 4. Chang Liu, Foundations of MEMS, Pearson Education International, New Jersey, USA, 2011.

e-Resources:

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BioMEMS

To expose the knowledge on BioMEMS, miniaturization techniques and its application in biomedical

Introduction- MEMS and Microsystems- Microsystem products- Principles of Micro systems-Microsensors- acoustic wave sensors, chemical sensors- optical sensors- Pressure sensors- thermal sensors- Microactuation- MEMS with Microactuators- Microaccelerometers- Microfludics. Micro

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- 1. <u>https://nptel.ac.in/courses/112/104/112104181/</u>," BioMEMS and Microsystems ", Dr.Shantanu Bhattacharya, Department of Mechanical Engineering, IIT Kharagpur
- 2. <u>https://nptel.ac.in/courses/117/105/117105082/</u>, "MEMS and Micro systems", Prof.Santiram Kal, Dept of EEE, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the basics of mems and microsystems.
- CO2 Describe the functions, properties of microsensors and thermo fluid engineering.
- CO3 Discuss the different types of materials used in the miniaturization process.
- CO4 Illustrate the manufacturing and fabrication of micro systems.
- CO5 Explain the process of packaging and its types.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 2	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 3	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 4	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 5	3	1	1	-	_	1	-	1	-	-	_	_	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Pre-requisites : Nil

Preamble

22MDE23

This course introduces the basic hardware requirement along with various assistive devices. It also provides the prosthetic and orthotic devices knowledge in assistive devices.

UNIT 1 CARDIAC ASSIST DEVICES

Principle of External counter pulsation techniques, intra aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT 2 HEMODIALYSERS

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

UNIT 3 HEARING AIDS

Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT 4 PROSTHETIC AND ORTHOTIC DEVICES

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, sensory assist devices.

UNIT 5 RECENT TRENDS

Transcutaneous electrical nerve stimulator, bio-feedback, Recent trends in assistive technology for mobility, Adaptability of Assistive Mobility Devices and the Role of the Internet of Medical Things.

TEXT BOOKS:

- 1. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, "Clinical Engineering", CRC Press, 1st edition,2010.
- 2. Marion. A. Hersh, Michael A. Johnson, "Assistive Technology for visually impaired and blind", SpringerScience & Business Media, 1st edition, 2010.

REFERENCES:

- 1. Kenneth J. Turner Advances in Home Care Technologies: Results of the match Project, Springer, 1st edition, 2011.
- 2. Matthew Dipaola, "3D Printing in Orthopaedic Surgery", Elsevier Health Sciences, 2018
- 3. Albert M. Cook, Janice Miller Polgar, "Assistive Technologies", Elsevier Health Sciences, 2019.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/109106168</u>, "Disability Studies: An introduction", Prof. Hemachandran Karah, IIT Madras.
- 2. <u>https://onlinecourses.swayam2.ac.in/aic19_ge01/preview</u>, "Development of Assistive technology for persons with Disabilities", Indumathi Rao, C B R Network.

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Interpret the various mechanical techniques that will help in assisting the heart Functions.
- CO2 Describe the underlying principles of hemodialyzer machine
- $\label{eq:cost} CO3 \quad \mbox{Indicate the methodologies to assess the hearing loss.}$
- CO4 Evaluate the types of assistive devices for mobilization.
- CO5 Explain about TENS and biofeedback system.

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TOTAL : 45 PERIODS

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Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 2	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 3	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 4	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 5	3	1	1	-	-	1	-	1	-	-	-	-	-	-
1: Slight (Lo	w)	2: N	Iodera	te (M	edium))	3: Sul	bstanti	al (Hi	gh)	"-" N	No cor	relation	ı

22MDE24

ICU AND OT EQUIPMENT

Preamble

This course offers clear understanding of various intensive care equipment and their working .It enables the students to understand the necessity of different operation theatre equipment.

UNIT 1 INTENSIVE CARE UNIT EQUIPMENT

Suction apparatus, Different types; Sterilizers, Chemical, Radiation, Steam for small and large units. ICU ventilators. Automated drug delivery systems, Infusion pumps, components of drug infusion system, closed loop control infusion system, implantable infusion system.

UNIT 2 CRITICAL CARE EQUIPMENT

Defibrillators, Hemodialysis Machine, Different types of Dialyzers, Membranes, Machine controls and measurements. Heart Lung Machine, different types of oxygenators, peristaltic pumps, Incubators...

UNIT 3 OPERATION THEATRE EQUIPMENT

Craniotomy, Electrosurgical Machines (ESU), electrosurgical analyzers, surgical aspirator, Instruments for operation. Anesthesia Machine, Humidification, Sterilization aspects, Boyles apparatus. Endoscopy – Laparoscopy - Cryogenic Equipment - Anesthesia gas, Anesthesia gas monitor, - surgical microscope.

UNIT 4 CENTRALISED SYSTEMS

Centralized Oxygen, Nitrogen, Air supply & Suction. Centralized Air Conditioning, Operation Theatre table & Lighting. C Arm.

UNIT 5 PATIENT SAFETY

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.

TEXT BOOKS:

- 1. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India PvtLtd,New Delhi, 2015.
- 2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2012.

REFERENCES:

- 1. Khandpur R.S, "Handbook of Biomedical Instrumentation", McGraw-Hill Education, Third Edition 2014.
- 2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.
- 3. Antony Y.K.Chan,"Biomedical Device Technology, Principles and design", Charles ThomasPublisher Ltd, Illinois, USA, 2008.

e-Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc20_ge14/preview</u>, "Regulatory requirements for medical devices including in vitro diagnostics in India", Shri Aseem Sahu, Shri. Malay Mitra, CDSCO, Ministry of Health & Family Welfare.
- 2. <u>https://nptel.ac.in/courses/127106010</u>, "Regulatory requirements for medical devices and IVDs in India", Prof. A. B. Ramteke, Prof. Malay Mitra, CDSA,DBT.

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TOTAL: 45 PERIODS

Course Outcomes: Upon completion of this course, students will be able to:

- **CO1** Apply the knowledge acquired, in designing new monitoring devices for ICU and assist the medical personnel's during emergency situations.
- **CO2** Suggest suitable surgical instruments and operational devices.
- **CO3** Compare the various techniques for clinical diagnosis, therapy and surgery, and its recent methods.
- CO4 Assess the merits of the operation theatre equipment based on its applications
- CO5 Design the devices for the particular application based on given specifications

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 2	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 3	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 4	3	1	1	-	-	1	-	1	-	-	-	-	-	-
CO 5	3	1	1	-	-	1	-	1	-	-	-	-	-	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Mod

2: Moderate (Medium)

3: Substantial (High) "-" No

22MDE25

ANALYTICAL INSTRUMENTATION

Pre-requisites : Nil

Preamble

The course is designed to equip the students with an adequate knowledge on analytical tools that are being used for clinical analysis in hospitals, drugs and pharmaceutical laboratories and above all for radiation monitoring and control.

UNIT 1 COLORIMETRY AND SPECTROPHOTOMETRY

Special methods of analysis – Beer-Lambert law, Colorimeters – UV-Vis spectrophotometers – Single and double beam instruments– Sources and detectors – I spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers.

UNIT 2 CHROMATOGRAPHY

Different techniques – Gas chromatography – Detectors – Liquid chromatographs – Applications – Highpressure liquid chromatographs – Applications.

UNIT 3 GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS

Types of gas analyzers – Oxygen, NO2 and H2S types– IR analyzers– thermal conductivity analyzers– analysis based on ionization of gases. Air pollution due to carbon monoxide– hydrocarbons– nitrogen oxides– sulphur dioxide estimation - Dust and smoke measurements

UNIT 4 pH METERS AND DISSOLVED COMPONENT ANALYZERS

Principle of pH measurement– glass electrodes– hydrogen electrodes– reference electrodes– selective ion electrodes– ammonia electrodes– biosensors– dissolved oxygen analyzer – Sodium analyzer – Silicon analyze

UNIT 5 RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES

Nuclear radiations – Detectors – GM counter – Proportional counter – Solid state detectors – Gamma cameras – X- ray spectroscopy – Detectors – Diffractometers – Absorption meters – Detectors. NMR – Basic principles – NMR spectrometer - Applications. Mass spectrometers – Different types – Applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. R.S. Khandpur, "Handbook of Analytical Instruments", Tata McGraw Hill publishing Co. Ltd., 3rdEdition, 2015.
- 2. Douglas A. Skoog, F. James Holler, and Stanley R. Crouch "Principles of Instrumental Analysis", Cengage Learning,7th Edition, 2018..

REFERENCES:

- 1. Xingdong Zhang, David Williams, "Definitions of Biomaterials for the Twenty-First Century", Elsevier, 1st Edition, 2019.
- 2. Karoly Vekey, Andreas Telekes, Akos Vertes, "Medical Applications of Mass Spectrometry,Elsevier", 1st Edition,2008.
- 3. James keeler, "Understanding NMR Spectroscopy", 2ndJohn Wiley & Sons, 2010.

e-Resources:

1. <u>https://nptel.ac.in/courses/103/108/103108100/</u>, "Modern Instrumental Methods of Analysis", Dr. J.R.Mudakavi ,Department of Chemical Engineering, IISC Bangalore.

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2. <u>https://nptel.ac.in/courses/104/101/104101117/</u>, "NMR spectroscopy for Chemists and Biologists", Dr. Ashutosh Kumar, Department of Biosciences and Bioengineering, IIT Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Classify different types of materials and its application in biomedicine.
- CO2 Analyze the structure, properties, synthesis process of metals, ceramics and carbon to provide
- CO3 Analyze the roles of the natural and synthetic polymer in developing the medical devices.
- CO4 Choose materials for design of implants in tissue replacement and Evaluate response of biomaterials in living system
- CO5 Summarize Methods to repair and regenerate injured or lost functional tissue with materials, stem cells.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1	0	0	0	0	1	0	0	1	0
CO2	3	3	3	2	1	0	0	0	0	1	0	0	1	0
CO3	3	2	2	2	1	0	0	1	1	1	0	0	1	0
CO4	3	2	2	2	1	0	0	1	1	1	0	0	1	0
CO5	3	2	2	2	1	0	0	1	1	1	0	0	1	0

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDE26 MEDICAL EQUIPMENT MAINTENANCE AND TROUBLESHOOTING 3 0 0 3

Pre-requisites : Nil

Preamble

This course intends to provide an understanding about maintenance and trouble shooting of Medical Equipment.

UNIT 1 INTRODUCTION

Testing of electrical equipments: AC, DC power supply, Grounding, shielding, Guarding, insulation testing, insulation resistance measurement, Types of Circuit Breakers, Rating - Testing of circuit breakers – Tranformer testing- Earthing – Earth wires - Earthing of appliances – contactor, relay testing–CT and PT, Panel wiring- Megger-Testing equipments and instruments.

UNIT 2 TESTING AND TROUBLESHOOTING

Testing of electronic components: Troubleshooting of PCB boards, Calibration of analog and digital sensor probe, Display interface, DC Power supply design, testing, Safe electrical practice, Cables and standard, Fuse.

UNIT 3 TESTING OF MEDICAL EQUIPMENT

Testing of surgical Equipment: Functions and operating procedure-Testing and maintenance of Heart lung machine, surgical lights, ventilator, patient monitor, anesthesia machine, dialyzer, surgical tools.

UNIT 4 TROUBLESHOOTING OF MEDICAL EQUIPMENT

Troubleshooting of equipments: X-ray machines, Troubleshooting of ECG recorders, incubator, baby warmer, infusion pumps, annual maintenance, contract requirements, vendor services, and quality and safety standards.

UNIT 5 MAINTENANCE MANAGEMENT

Life cycle management of medical equipment: Cost of the medical equipment, maintenance cost, replacement analysis, Managing equipment service, decision making, extracting optimal benefit from medical equipment over its life cycle. Case study.

TEXT BOOKS:

- 1. Binseng Wang, "Medical Equipment Maintenance", Springer International Publishing, 2022
- 2. Operating guide for medical Equipment Maintenance, Issue 1 of Army TB, Headquarters department of Army, 2008

REFERENCES:

- 1. Ernesto Iadanza, "Clinical Engineering Handbook", Second Edition, Elsevier Science, 2019.
- 2. Maintenance Management Procesures for Medical Equipment, Headquaters, Department of the Army, University of Virginia, 2008
- 3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment technology", Pearson Education, 4th Edition, 2014.

e-Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc21_ee55/preview</u>, "Basic Electronics", Prof. M.B. Patil, IIT Bombay.
- 2. <u>https://archive.nptel.ac.in/courses/112/105/112105232/</u> "NOC:Machinery Fault Diagnosis and Signal Processing," Prof. Amiya Ranjan Mohanty, IIT-Kharagpur

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TOTAL : 45 PERIODS

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Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Identify major reasons for equipment failure.
- CO2 Compare general testing and troubleshooting of equipment.
- CO3 Understand testing of OT instruments.
- CO4 Discuss about the troubleshooting of medical equipment and safety standards.
- CO5 Analyze the management issues pertaining to medical instruments.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1	1	1	0	0	1	0	0	1	0
CO2	3	3	2	2	1	1	1	0	0	1	0	0	1	0
CO3	3	2	3	2	1	1	1	0	0	1	0	0	1	0
CO4	3	2	2	3	1	1	1	0	0	1	0	0	1	0
CO5	3	2	2	2	1	1	1	0	0	1	0	0	1	0

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

) 3: Substantial (High)

MEDICAL DEVICE PACKAGING

Pre-requisites : Nil

Preamble

Medical Device Packaging is an important factor to place the device in the market safe and secured during the shelf life. This course enables the students to understand medical device packaging, giving them an idea of the dynamic opportunities available to medical device packaging engineers.

UNIT 1 INTRODUCTION

Medical Device Packaging- Medical Device Packaging Types-MDR Requirements-Packaging Standards-Process Validation. Non- Sterile Packaging Requirements-Benefits of packaging.

UNIT 2 MEDICAL DEVICE PACKAGING

Regulations of Medical devices- medical device definition- testing standards-good manufacturing compliance- establishment registration-medical device reporting.

UNIT 3 PACKAGE VALIDATION

Overview of package validation- Elements of package validation-validation testing-process sampling-validation reporting- ISO Standard / ISO 11607 Part 1, 2 & EN 868-1.

UNIT 4 LABELS AND LABELLING

Labelling Requirements- NDC Number-Label Construction- Bar code administration-universal product code number-global trade item number-barcodes, Recent trends.

UNIT 5 STERILIZATION OF MEDICAL DEVICES

Sterilization Requirements- Types of Sterilizing medical devices on packaging-Monitoring Sterilization Processes- Mechanical, Chemical, and Biologic Indicators.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Edward.J.Bauer, "Pharmaceutical Packaging Handbook", Informa Healthcare USA, Inc, 2017.
- 2. Max Sherman, "Medical Device Packaging Handbook", Second Edition, CRC Press, 2016

REFERENCES:

- 1. H.Lockhart," Packaging of pharmaceuticals and Healthcare Products", Springer, 2018.
- 2. Ronald Pilchik," Validating Medical Packaging", CRC Press, 2012.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/127106136</u>, "Regulatory requirements for medical devices including in vitro diagnostics in India (Version 2.0)", Prof. Arun B.Ramteke, Prof. Aseem Sahu, Prof. Malay Mitra, IIT Madras.
- 2. <u>http://engineeringvideolectures.com/course/457</u>, "An Introduction to electronic system packaging", Prof G.V.Mahesh, Department of Electronic systems engineering, Indian institute of science, Bangalore.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Identify major reasons for equipment failure.
- CO2 Compare general testing and troubleshooting of equipment.
- CO3 Understand testing of OT instruments
- CO4 Discuss about the troubleshooting of medical equipment and safety standards
- CO5 Analyze the management issues pertaining to medical instruments.

L T P C 3 0 0 3

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Mapping of COs with POs and PSOs

Cos/POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	1	0	0	0	1	0	0	1	0
CO2	3	3	2	2	2	1	0	0	0	1	0	0	1	0
CO3	3	2	3	2	2	1	0	0	0	1	0	0	1	0
CO4	3	2	2	3	2	1	0	0	0	1	0	0	1	0
CO5	3	2	2	2	2	1	0	0	0	1	0	0	1	0
1: Slight (Low) 2: Moderate (Medium)						3: Sul	bstanti	al (Hig	gh)	"-" No correlation				

22MDE31

FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

L T P C 3 0 0 3

Pre-requisites : Nil

Preamble

This course introduces engineering students to the foundational concepts, methods, and tools involved in integrated product development. It focuses on developing the skills necessary to design, develop, and bring innovative products to market while considering various factors such as customer needs, technical feasibility, cost, and time constraints.

UNIT 1 BASICS OF PRODUCT DEVELOPMENT

Global Trends Analysis and Product decision - Social Trends - Technical Trends - Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT 2 REQUIREMENTS AND SYSTEM DESIGN

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT 3 DESIGN AND TESTING

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & 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 Schematic, Component design, Layout and Hardware Testing – Prototyping -Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation.

UNIT 4 SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT

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 5 BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY

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 Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, 6th Edition, 2016.
- 2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, 12th Edition, 2007.
- 3. Dr. P. Alli and C. B. Selvalakshmi, "Foundation Skills in Integrated Product Development", Technical Publications, 1st edition, 2020.

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REFERENCES:

- 1. Hiriyappa B, "Corporate Strategy Managing the Business", Author House, 2013.
- 2. Peter F Drucker, "People and Performance", Butterworth Heinemann [Elsevier], Oxford, 2007.
- 3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning Concepts", 2nd Edition, Prentice Hall, 2004.
- 4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, 7th Edition, 2013.

e-Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc21_me83/preview</u>, "Product Design and Development" by Prof. Inderdeep Singh, IIT Roorkee.
- 2. https://www.academia.edu/33089267/FOUNDATION_SKILLS_IN_INTEGRATED_PRODUC T_DEVELOPMENT, SriRam Kumar & P Krishna Sankar.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Understand the key concepts and principles of integrated product development.
- CO2 Apply systematic and structured approaches to product development.
- CO3 Utilize appropriate tools and techniques for product design, analysis, and evaluation.
- CO4 Collaborate effectively in cross-functional teams for product development projects.
- CO5 Communicate product ideas, specifications, and requirements through effective documentation and presentations.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	3	1	-	-	-	-	-	1	-	1	-	-
CO 2	3	2	3	1	-	-	-	-	1	1	-	1	-	-
CO 3	3	2	3	1	1	-	-	1	1	1	-	1	-	-
CO 4	3	2	3	1	1	-	-	1	1	1	-	1	-	-
CO 5	3	2	3	1	1	-	-	1	1	1	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDE32PATIENT SAFETY, STANDARDS AND ETHICSLTP300

Pre-requisites : Nil

Preamble

This course enables students to understand the importance of patient safety against electrical hazards and understand the patient safety laws and regulations.

UNIT 1 EFFECTS OF ELECTRICITY

Physiological effects of electricity - important susceptibility parameters - micro shock - macro shock hazards -patients electrical environment - isolated power system - conductive surfaces.

UNIT 2 PATIENT SAFETY LAWS AND REGULATIONS

Mandatory Reporting systems. Anatomy of a patient safety Law: Compliance Tips, Federal patient safety Legislation Initiatives, Medical Device Reporting, Clinical trials and Adverse-Event Reporting, Patient safety Goals and standards, The Quality Assessment and performance Improvement rule.

UNIT 3 STANDARDS AND TESTING

Guidelines and safety practices to improve patient safety, Electrical safety codes and standards - IEC 60601-1 2005 standard, Basic Approaches to protection against shock, protection equipment design, Electrical safety analyser - Testing the electric system.

UNIT 4 PATIENT SAFETY IN MAIN CLINICAL SPECIALITIES

Intensive care and Anesthesiology, safety surgery save lives, Emergency department clinical risk, Obstetric safety patient, Patient safety in internal medicine, Patient safety in Radiology.

UNIT 5 MEDICAL ETHICS

Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics- Fundamental Responsibilities, The Doctor and The Patient, The Doctor and The Profession, Professional Independence, The Doctor And Society, Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. John G.Webster, "Medical Instrumentation Application and design", 4th edition, Wiley India Pvt. Ltd., New Delhi, 2015.
- 2. Liam Donaldson, Walter Ricciardi, "Textbook of patient safety and clinical Risk management", Springer, Open Access.

REFERENCES:

- 1. Fay A. Rozovsky, James R. Woods, Jr, "The Handbook of Patient Safety Compliance", 2016
- 2. Bill Runciman, Merrilyn Walton, "Safety and Ethics in Healthcare: A Guide to Getting it Right", CRC Press, 2017.

e-Resources:

- 1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7727331/
- <u>https://onlinecourses.nptel.ac.in/noc24_ge33/preview</u>, "Medical Law", Prof. Narendran Thiruthy & Prof. Chaitanya Mittal, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Outline the importance of patient safety against electrical hazards.
- CO2 Brief out the patient safety laws and regulations.
- CO3 Explain the standards and testing of patient.

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- Understand the concept of the patient safety specialties in clinical environment. Know about various health care organizations. CO4
- CO5

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 2	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 3	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 4	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 5	3	2	1	1	1	-	-	2	-	1	-	1	-	-
1. Slight (Low) 2. Moderate (Medium))	3. 511	hetanti	al (Hi	" " N	" " No correlation				

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDE33

MEDICAL DEVICE REGULATIONS

L T P C 3 0 0 3

Pre-requisites : Nil

Preamble

This course provides an in-depth understanding of the regulatory requirements and standards governing the design, development, and manufacturing of medical devices. Students will learn about the global regulatory landscape, quality management systems, risk management, and other essential aspects of medical device regulations.

UNIT 1 MEDICAL DEVICE REGULATIONS

History of medical device regulation, regulatory affairs professional's roles, required competencies, medical device classification: scope, definitions, main classifications, Risk based classification, practical examples, labeling of medical devices: definition, elements, risk management, clinical evaluation and labeling, language level and intended users. Differentiating medical devices IVDs and combination products from that of pharmaceuticals.

UNIT 2 ISO STANDARDS

ISO 13485:2016: Requirements for regulatory purposes: Quality Management Systems, certification process. ISO 14971: Application of Risk management to medical Devices.

UNIT 3 IEC, REGULATORY SYSTEMS IN USA & EU

IEC international standards and conformity assessment for medical devices, Good submission process, medical device regulatory system in the USA and European Union.

UNIT 4 INDIAN REGULATORY SYSTEM

India: Medical device regulatory system: market environment, functions undertaken by DGGI, central government, FDA and state governments, guidance documents, details of key regulators, IMDRF and CDSCO, regulatory overview in India, product registration on conformity assessment, quality system regulation, technical material and labeling requirements, commercial aspects, upcoming regulation changes.

UNIT 5 CLINICAL TRIALS AND DIGITAL REGULATIONS

Regulatory strategy and competitive advantage, Preclinical and Clinical Trial Design for Medical Devices in India; FDA approved devices, post-market surveillance/vigilance, Digital health regulations: Connected care, intelligent design control, reducing design time and cost with in-silico clinical trials.

TEXT BOOKS:

- 1. Medical Regulatory Affairs: An International Handbook for Medical Devices and Healthcare Products, 3rd Edition, Taylor & Francis Group, 2021
- 2. Richard Fries, "Reliable Design of Medical Devices", 3rd Edition, CRC Press, 2012

REFERENCES:

- 1. Richard C Fries, "Medical Device Quality Assurance and Regulatory Compliance", CRC Press, 2014.
- 2. Gert Bos & Jocelyn Jennings, "Fundamentals of Medical Device Regulations", RAPS publications, 5th Edition, 2022.

e-Resources:

1. <u>https://nptel.ac.in/courses/127106136</u>, "Regulatory requirements for medical devices including

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TOTAL : 45 PERIODS
in vitro diagnostics in India", Prof. Arun B.Ramteke, Prof. Aseem Sahu & Prof. Malay Mitra, IIT Madras.

2. World Health Organization. (2003). Medical device regulations : global overview and guiding Principles. https://apps.who.int/iris/handle/10665/42744

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Define and explain the basic concepts of medical device regulations.
- CO2 Decipher the meaning of ISO standards from a regulatory perspective.
- CO3 Explain US-FDA, IEC and European regulations.
- CO4 Discuss regulations in India.
- CO5 Explain the regulatory aspects of clinical trials and digital alternatives

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 2	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 3	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 4	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 5	3	2	1	1	1	-	-	2	-	1	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDE34 ELECTRICAL SAFETY AND QUALITY ASSURANCE L T P C

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Pre-requisites : Nil

Preamble

To provide basic knowledge on the concept of Healthcare Quality management towards continuous improvement of patient care and make the students aware of the role of biomedical engineer in hospitals, especially in the management of electrical supply, maintenance of electrical safety. The purpose of this course is to help students to develop knowledge and insight into the procedures used in quality control and assurance activities as well as safety measures to be followed in hospitals.

UNIT 1 STANDARDIZATION OF QUALITY MEDICAL CARE IN HOSPITALS

Define Quality – Need for Standardization & Quality Management – TQM in Health care organization – Quality assurance methods – QA in (Medical Imaging & Nuclear medicine) Diagnostic services – Classification of equipments.

UNIT 2 REGULATORY REQUIREMENT FOR HEALTH CARE

FDA regulations - Accreditation for hospitals - JCI, NABH and NABL - Other regulatory Codes.

UNIT 3 HOSPITAL SAFETY

Security & Safety of Hospital – Property, Staff & Patients, Radiation safety – Safety precautions– Hazardous effects of radiation – Levels of radiation– ICRP regulations for radiation safety – Disposal of Biological waste.

UNIT 4 ELECTRICAL & FIRE SAFETY

Sources of shocks- macro & micro shocks- Hazards- Monitoring and interrupting the Operation from leakage current- Elements of fire - Causes of fire - Action to be taken in case of fire in a Hospital.

UNIT 5 ASSESSING QUALITY HEALTH CARE

Patient Safety Organization- Governmental & Independent, Measuring Quality care – Evaluation of hospital services – six sigma way, Quality Assurance in Hospitals Sop's – Patient Orientation for Total Patient Satisfaction- 5S techniques.

TEXT BOOKS:

- 1. Cesar A. Caceres, "Medical Devices: Measurements, Quality Assurance, and Standards", ASTM International, 2017.
- 2. Sharon Myers, "Patient Safety & Hospital Accreditation A Model for Ensuring Success", Springer Publishers, 2012.

REFERENCES:

- 1. Steli Loznen, Constantin Bolintineanu, Jan Swart, "Electrical Product Compliance and Safety Engineering", Artech House, 2017.
- 2. Joseph D. Bronzino, "Management of Medical Technology: A Primer for Clinical Engineers", Butterworth-Heinemann, 2014.
- 3. Joseph Dyro, "Clinical Engineering Handbook", Elsevier, 2014.

e-Resources:

1. <u>https://www.energy.gov/orem/safety-quality-assurance</u>

TOTAL : 45 PERIODS

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- <u>https://onlinecourses.swayam2.ac.in/nou20_cs08/preview</u>,
 "Electricity & Safety Measures", Dr. Rakhi Sharma, Indira Gandhi National Open University.
- 3. <u>https://www.classcentral.com/course/swayam-electricity-safety-measures-22958</u>

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Interpret quality assurance for medical imaging and nuclear medicine equipments available in hospitals.
- CO2 Acquire knowledge on Accreditation procedures and regulatory codes for hospitals.
- CO3 Discriminate between safety measures and disposal of biomedical wastes.
- CO4 Interpret the precautionary steps and action taken for electrical fire hazards in hospital.
- CO5 Develop knowledge into the procedures used in quality control and assurance activities to be followed in hospitals.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	3	2	-	-	-	2	-	-	1	-	1	-	-
CO 2	1	3	1	-	-	-	2	-	-	1	-	1	-	-
CO 3	1	3	2	_	-	-	2	-	-	1	-	1	-	-
CO 4	1	3	2	-	-	-	2	-	-	1	-	1	-	-
CO 5	1	3	2	-	-	-	2	-	-	1	-	1	-	-
1: Slight (Lo	w)	2: N	Iodera	te (Me	edium)		3: Su	bstanti	al (Hi	gh)	"-" N	lo cor	relation	!

Mapping of COs with POs and PSOs

22MDE35 MEDICAL INNOVATION AND ENTREPRENEURSHIP

Pre-requisites : Nil

Preamble

This course is designed to provide engineering students with an understanding of medical innovation and entrepreneurship in the healthcare industry. Students will learn about the latest advancements in medical technology, explore the process of developing and commercializing medical devices, and gain knowledge about the key principles of entrepreneurship in the healthcare sector. The course will cover topics such as market analysis, intellectual property, regulatory requirements, business models, funding strategies, and ethical considerations in medical innovation.

UNIT 1 CREATIVITY, INNOVATION AND IPR

The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process. Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges.

UNIT 2 SCOPE FOR BIOMEDICAL ENGINEERING ENTREPRENEURSHIP

Definition– Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs. Fundamentals and models, Advancements in biomedical field, Supporting societies and professional activities. Impact of innovation in medical devices. Case study.

UNIT 3 NEW VENTURE

Developing an Effective Business Model: The Importance of Business Model – Starting a small-scale industry - Components of an Effective Business Model. Assessing the venture, establish venture invention, market research, presenting the business plan. Forms of Business Organization: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. case study.

UNIT 4 FINANCING THE NEW VENTURE AND GLOBALIZATION

Evaluating Various options and future investments – Medical Device entrepreneurship incentives and subsidies – Determining Financial Needs – Sources of Financing: support for product development, funding agencies, collaborative initiatives, and angel investors. Impact of Globalization: Medical product manufacturing, marketing, leadership, quality management. Case studies.

UNIT 5 MARKETING FUNCTION

Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process. Case study.

TOTAL : 45 PERIODS

TEXT BOOKS:

- Jen-Shih Lee "Biomedical Engineering Entrepreneurship", World Scientific Publishing, USA. 2010
- 2. Vasant Desai, "The Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 6th edition, 2016.

REFERENCES:

- 1. Brant Cooper, Patrick Vlaskovits, "The Lean Entrepreneur", Wiley, 2nd edition, New Jersey, 2016.
- 2. Nathan Furr, Jeff Dyer, "The Innovator's Method: Bringing the Lean Start-up into Your Organization", Harvard Business Press, Boston, 2014.

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- 3. Donald F.Kuratko and Richard M. Hodgetts, "Entrepreneurship: Theory, Process and Practice", South-Western, 6th edition, 2003.
- 4. Gupta S.L., Arun Mittal, "Entrepreneurship Development", International Book House, 2012.
- 5. Prasanna Chandra, "Projects- Planning, Analysis, Financing, Implementation and review, TATA McGraw Hill, 2012.
- 6. Sudha G. S., "Management and Entrepreneurship Development", Indus Valley Publication, 2009.

e-Resources:

- 1. <u>https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10007000/</u>
- 2. <u>https://hms.harvard.edu/about-hms/campus-culture/innovation-entrepreneurship-hms</u>

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Describe the role of biomedical engineers in entrepreneurship
- CO2 Interpret the background for biomedical engineers in entrepreneurship
- CO3 Acquire the skills and techniques required towards innovation
- CO4 Categorize the resources and funding agencies and judge the right product based on market needs
- CO5 Compile and quantify the opportunities and challenges

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 2	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 3	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 4	3	2	1	1	1	-	-	2	-	1	-	1	-	-
CO 5	3	2	1	1	1	-	-	2	-	1	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

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Pre-requisites : Nil

Preamble

The course is designed to provide engineering students with an understanding of intellectual property rights (IPR) and their role in innovation and technology commercialization. The course will cover the fundamentals of patent, copyright, trademark, and trade secret law, as well as international IPR regimes. Students will learn how to identify, protect, and manage intellectual property assets in the engineering field.

UNIT 1 INTRODUCTION

Introduction to IPRs– Basic concepts and need for Intellectual Property - Patents– Copyrights– Geographical Indications– IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS – Nature of Intellectual Property – Industrial Property– Technological Research– Inventions and Innovations – Important examples of IPR.

UNIT 2 REGISTRATION OF IPRs

Meaning and practical aspects of registration of Copy Rights- Trademarks- Patents- Rights and Duties of Patentee- Geographical Indications- Trade Secrets and Industrial Design registration in India and Abroad.

UNIT 3 AGREEMENTS AND LEGISLATIONS

International Treaties and Conventions on IPRs- TRIPS Agreement- PCT Agreement- Patent Act of India-Patent Amendment Act- Design Act- Trademark Act- Geographical Indication Act.

UNIT 4 DIGITAL PRODUCTS AND LAW

Digital Innovations and Developments as Knowledge Assets – IP Laws– Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT 5 ENFORCEMENT OF IPRs

Infringement of IPRs- Enforcement Measures- Emerging issues - Case Studies.

TEXT BOOKS:

- 1. Vinod V. Sople, "Managing Intellectual Property The Strategic Imperative", PHI Learning, 4th Edition, 2014.
- V. Satakar, "Intellectual Property Rights and Copy Rights", EssEss Publications, New Delhi, 2003

REFERENCES:

- 1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and TradeSecrets", Cengage Learning, 3rd Edition, 2012
- 2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw HillEducation, 1st Edition, 2017.
- 3. Derek Bosworth and Elizabeth Webster, "The Management of Intellectual Property", Edward ElgarPublishing Ltd., 2006.

e-Resources:

- <u>https://nptel.ac.in/courses/110105139</u>, "Intellectual property rights and competition law", Prof. K. D. Raju, IIT Kharagpur.
- 2. <u>https://nptel.ac.in/courses/127/105/127105008/</u>, "Roadmap for patent creation", Prof. Gouri

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TOTAL : 45 PERIODS

Gargate, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Imbibe the knowledge of Intellectual Property and its protection through various laws
- CO2 Apply the knowledge of IPR for professional development
- CO3 Develop a platform for protection and compliance of Intellectual Property Rights & knowledge
- CO4 Create awareness amidst academia and industry of IPR and Copyright compliance
- CO5 To manage intellectual property portfolio to enhance the value of firm

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	3	-	-	-	-	2	-	-	1	-	1	-	-
CO 2	1	3	-	-	-	-	2	-	-	1	-	1	-	-
CO 3	1	3	-	-	-	-	2	-	-	1	-	1	_	-
CO 4	1	3	-	-	-	-	2	-	-	1	-	1	-	-
CO 5	1	3	-	-	-	-	2	-	-	1	-	1	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

APPLIED DESIGN THINKING

Pre-requisites : Nil

Preamble

To introduce tools & techniques of design thinking for innovative product development and to illustrate customer-centric product innovation using on simple use cases. This course demonstrates the development of Minimum usable Prototypes and outline principles of solution concepts & their evaluation.

UNIT 1 DESIGN THINKING PRINCIPLES

Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR (Forge Innovation rubric) - Case studies

UNIT 2 ENDUSER-CENTRIC INNOVATION

Importance of customer-centric innovation - Problem Validation and Customer Discovery -Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit

UNIT 3 APPLIED DESIGN THINKING TOOLS

Concept of Minimum Usable Prototype (MUP) - MUP challenge brief - Designing & Crafting the value proposition - Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design.

UNIT 4 CONCEPT GENERATION

Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts

UNIT 5 SYSTEM THINKING

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Steve Blank, "The four steps to epiphany: Successful strategies for products that win", Wiley, 2013.
- 2. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Business, 2012.
- 3. Donella H. Meadows, "Thinking in Systems A Primer", Sustainability Institute, 2015.

REFERENCES:

- 1. Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith & Trish Papadakos, "Value Proposition Design: How to Create Products and Services Customers Want", John Wiley & Sons Inc, 2014.
- 2. Anuja Agarwal, "Design Thinking: A Framework for Applying Design Thinking in Problem Solving", Cengage, 1st edition, 2024

e-Resources:

- 1. <u>https://www.ideou.com/pages/design-thinking#process</u>
- 2. <u>https://onlinecourses.nptel.ac.in/noc22_mg32/preview</u>, "Design Thinking A Primer", Prof. Ashwin Mahalingam & Prof. Bala Ramadurai, IIT Madras

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3. <u>https://nptel.ac.in/courses/109104109</u>, "Understanding Design Thinking & People Centred Design", Prof. Jhumkee Iyengar, IIT Kanpur

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Define & test various hypotheses to mitigate the inherent risks in product innovations.
- CO2 Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
- CO3 Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching
- CO4 Apply system thinking in a real-world scenario.
- CO5 Describe system thinking principles as applied to complex systems

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	3	2	-	-	-	2	-	-	2	-	2	-	-
CO 2	1	3	2	-	-	-	2	-	-	2	-	2	-	-
CO 3	1	3	2	-	-	-	2	-	-	2	_	2	-	-
CO 4	1	3	2	-	-	-	2	-	-	2	-	2	-	-
CO 5	1	3	2	-	-	-	2	-	-	2	-	2	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

HOSPITAL PLANNING AND MANAGEMENT

Pre-requisites : Nil

Preamble

The course enables the students to explore various hospital management systems and relative supportive services. It also imparts knowledge on quality and safety aspects in hospitals.

UNIT 1 OVERVIEW OF HOSPITAL ADMINISTRATION

Planning the Hospital - Guiding Principles in Planning Hospital Facilities and Services - Preliminary Survey - Financial Planning - Equipment Planning - Planning the Hospital Building - Purchase of Capital Equipment - Organizational Structure - Chief Executive Officer (CEO): Qualities, Duties, Responsibilities and Functions - Organizational Charts.

UNIT 2 HUMAN RESOURCE MANAGEMENT IN HOSPITAL

Principles of HRM - Functions of HRM - Profile of HRD Manager - Tools of HRD - Human Resource Inventory - Manpower Planning. Recruitment - Selection - Training - Grooming Leaders - Promotion -Transfer - Dismissal - Resignation - Communication: nature, scope, purpose, barriers, styles and modes of communication.

UNIT 3 MEDICAL AND SUPPORTIVE SERVICES

Outpatient Services - Clinical Laboratory Services - Surgical Department - Hospital Information System - General Nursing units - Intensive Care Units - Medical Records - Pharmacy - Central Sterile Supply Department (CSSD) - Materials Management - Hospital Linen and Laundry Services - House Keeping.

UNIT 4 HOSPITAL SERVICE MANAGEMENT

Engineering Department - Maintenance Management - Clinical Engineering - Electrical System - Air Conditioning System - Water Supply and Sanitary System - Centralized Medical Gas System -Communication System - Solid Waste Management - Transportation.

UNIT 5 QUALITY AND SAFETY ASPECTS IN HOSPITAL

Quality management system: Elements, Implementation, Documentation, Auditing - ISO Certification for Hospitals - Accreditation: NABH, JCI, NABL - Safety in Hospital – Security and Loss Prevention Programme - Fire safety - Alarm system - Disaster management.

TEXT BOOKS:

- D. K. Sharma and R. C. Goyal, "Hospital Administration and Human Resource Management", 1. PHI, 7th Edition, 2017.
- G. D. Kunders, "Hospitals Facilities Planning and Management", McGraw Hill Education, 1st 2. Edition. 2017.

REFERENCES:

- Cesar A. Caceres and Albert Zara, "The Practice of Clinical Engineering", Academic Press, New 1. York. 2012.
- Norman Metzger, "Handbook of Health Care Human Resources Management", 2nd Edition, 2. Aspen Publication Inc. Rockville, Maryland, USA, 1990.
- B. M. Sakharkar, "Principles of Hospital Administration and Planning", Jaypee Brothers Medical 3. Publishers Pvt Limited, 2nd Edition, 2009.

e-Resources:

https://onlinecourses.swayam2.ac.in/arp19_ap47/preview, "Emerging Areas In Hospital Planning 1.

TOTAL: 45 PERIODS

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Design Construction And Facilities Management", Dr.Anil Dewan, School of Planning and Architecture, New Delhi.

2. <u>https://nptel.ac.in/courses/110/104/110104095/</u>, "Economics of Health and Healthcare", Dr.Angan Sengupta, IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Describe hospital planning and administration to meet the requirements of accreditation.
- CO2 Identify the importance of human resource management to recruit, select, train and evaluate the performance of a healthcare professional.
- CO3 Discuss the role of medical and support services used for proper functioning of the hospitals.
- CO4 Interpret various Engineering and other essential services of a hospital
- CO5 Explain the benefits of hospital quality management system, ISO certification, accreditation and safety management system.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	-	-	1	-	1	-	1	-	-	1	-
CO 2	3	2	1	-	-	1	-	1	-	1	-	-	1	-
CO 3	3	2	1	-	-	1	-	1	-	1	1	-	1	-
CO 4	3	2	1	-	-	1	-	1	-	1	1	-	1	-
CO 5	3	2	1	-	-	1	-	1	-	1	1	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

L Т Р 22MDE42 **HEALTH MANAGEMENT INFORMATION SYSTEMS** 3 A

Pre-requisites : Nil

Preamble

This course imparts knowledge on the theories and practices adopted in hospital management information systems (HMIS) in the light of medical standards, medical data formats and recent trends adopted in hospitals, data storage and retrieval. It also focuses on ICT applications to healthcare professionals where they frequently come across information systems for the support of patient care, assessment of quality of care, medical research, decision-making, management and planning.

UNIT 1 INTRODUCTION TO HMIS

Introduction - Need - Benefits and capabilities of HMIS - Development of HMIS - Functional Areas -Modules forming HMIS - Computerized Physician Order Entry System (CPOE) - HMIS and Internet -Integrated Information system.

UNIT 2 HIS MODULES

Hospital Information System - Structure of HIS - Modules of HIS - Department Management -Organization Charts - Department Workflow - Evaluation of Department Operation and Services -Department Equipment and Supplies - Training and Development.

UNIT 3 COMPUTER BASED PATIENT RECORDS AND CODES

Computer Patient Records (CPR) - Evolution and Need - Development tools - CPR in Radiology - Legal - Security - Privacy Issues - Coding - Nomenclature and Classification - General Purpose Code Sets -Special Purpose Code Sets.

UNIT 4 RADIOLOGICAL INFORMATION SYSTEM

Radiological Information System- PACS - Components, Importing and Exporting Images to PACS, RIS, MPI and other Text Systems, Integrating with Other Systems. DICOM, HL-7.

UNIT 5 HEALTH INFORMATION PROCESSING AND ISSUES

Health Data Quality - Post Discharge Processing - Health Data scanning and Indexing - Record Analysis - Coding - Abstracting - Storage - Retention and Transcription - Confidentiality and Compliance -Preparing a record for release - Internal request for information - Federal, Corporate and facility compliance.

TEXT BOOKS:

- Nadinia Davis and Melissa LaCour, "Health Information Technology", Elsevier, 3rd Edition, 2014. 1.
- 2. Dinesh Bhatia, "Medical Informatics", PHI Learning Pvt. Ltd., Delhi, 2015.

REFERENCES:

- Edward H. Shortliffe, James J. Cimino, "Biomedical Informatics: Computer Applications in 1. Health Care and Biomedicine", Springer, 2021.
- 2. Ramachandra Lele, "Computers in Medicine: Progress in Medical Informatics", Tata McGraw Hill Publishing Company, New Delhi, 2006.
- 3. Alain Venot, "Medical Informatics, e-Health, Fundamental and Applications", Springer-Verlag Paris, 2014.

TOTAL : 45 PERIODS

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e-Resources:

- 1. <u>https://www.udemy.com/course/introduction-to-hospital-information-system/</u>, "Introduction to Hospital Information Systems", Professor Candelario.
- 2. <u>https://www.digimat.in/nptel/courses/video/102106065/L01.html</u> "Concepts and Importance of Bioinformatics", Prof. M. Michael Gromiha, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Categorize different functional areas such as inpatient and outpatient areas to integrate the clinical work flow.
- CO2 Implement different modules of computerized system in hospital to support clinical activity.
- CO3 Identify and interpret the impact of computers on continuing medical education programmes to accelerate the knowledge base to patient care.
- CO4 Summarize and compare RIS, HIS and PACS.
- CO5 Illustrate the strategy of acquisition, processing and transformation of clinical data into information data to improve medical care.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 2	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 3	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 4	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 5	3	2	1	1	2	-	-	1	-	-	-	-	1	1

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-

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Pre-requisites : Nil

Preamble

This course enables the students to understand various waste disposal procedures and management.

UNIT 1 BIOMEDICAL WASTE MANAGEMENT

Types of wastes - Major and minor sources of biomedical waste - Categories and classification of biomedical waste - Hazard of biomedical waste - Need for disposal of biomedical waste - Waste minimization - Waste segregation and labeling - Waste handling, collection, storage and transportation - Treatment and disposal.

UNIT 2 DISPOSAL OF WASTE AND PRINCIPLES OF STERILIZATION

Disposal methods - Incinerator - Hazardous waste - Radioactive waste - Liquid waste destruction - Landfill. Disease Transmission - Disinfection methods - Sterilization - Steam sterilizing (Autoclaving).

UNIT 3 HAZARDOUS MATERIALS

Hazardous substance safety - OSHA hazard communication standard - DOT hazardous material regulations - Healthcare hazardous materials - Medical gas systems - Respiratory Protection.

UNIT 4 INFECTION CONTROL AN D PREVENTION

Healthcare immunizations - Centers for disease control and prevention - Disinfectants, Sterilants, and antiseptics - OSHA bloodborne pathogens standard - Tuberculosis - Healthcare opportunistic infections - Medical waste.

UNIT 5 PATIENT SAFETY

An organizational function - Errors and adverse events - Safety cultures – Patient centered healthcare - Quality improvement tools and strategies - Medication safety – Emergency department patient safety – Ambulatory care patient safety.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Anantpreet Singh and Sukhjit Kaur, "Biomedical Waste Disposal", Jaypee Brothers Medical Publishers Pvt. Ltd., 2012
- 2. James T. Tweedy, "Healthcare Hazard Control and safety Management", CRC Press, Taylor and Francis Group, 3rd Edition, 2014.
- 3. Calvin R. Brunner, "Medical Waste Disposal", Incinerator Consultant incorporated, 1996.

REFERENCES:

- 1. Yves Chartier, "Safe Management of Wastes from Health-Care Activities", World Health Organization, 2nd Edition, 2014.
- 2. V. J. Landrum, "Medical Waste Management and disposal", William Andrew Publisher, 1st Edition, 1991

e-Resources:

- 1. <u>https://nptel.ac.in/courses/105/106/105106056/</u>, "Solid and Hazardous Waste Management", by Dr.Indumathi Nambi, IIT Madras.
- <u>https://swayam.gov.in/nd2_cec20_ge13/preview</u>, "Solid and Hazardous Waste Management", by Prof. V. K. Garg, Professor and Dean, School of Environment and Earth Sciences, Central University of Punjab, Bathinda.

Course Outcomes: Upon completion of this course, students will be able to:

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- CO1 Categorize different biomedical wastes based on its properties
- CO2 Describe the different methods used for waste disposal and basic principle of sterilization to avoid disease transmission
- CO3 Analyze various hazards, accidents and its control
- CO4 Explain the controls applied to waste management to prevent infectious diseases
- CO5 Summarize the patient safety in hospitals

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	-	-	1	2	1	-	-	-	1	1	-
CO 2	3	2	1	-	-	1	2	1	-	-	-	1	1	-
CO 3	3	2	1	-	-	1	2	1	-	-	-	1	1	-
CO 4	3	2	1	-	-	1	2	1	-	-	-	1	1	-
CO 5	3	2	1	-	-	1	2	1	-	-	-	1	1	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-

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Pre-requisites : Universal Human Values

Preamble

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This course enables the students to learn the legal and ethical principles in health care settings, medical standards that to be followed in hospitals, Professional ethics to be followed by Medical Electronics Engineers, patient safety and regulatory aspects followed in hospitals.

MEDICAL ETHICS AND STANDARDS

UNIT 1 MEDICAL ETHICS

Definition of Medical Ethics - Scope of Ethics in Medicine - International Code of Ethics for Occupational Health Professionals - Ethical Theories - Deontology & Utilitarianism - Casuist theory -Virtue Theory - The Right Theory - Role of Ethics in Healthcare workplace - Autonomy Non-Malfeasance - Beneficence - Veracity - Justice - OSHA - Decision Model for Healthcare Dilemmas - Applications of Plus Decision Making Model.

UNIT 2 CODE OF ETHICS

Bioethics - The principle of Double Effect - Code of Hammurabi - Engineering Competence - Ethical Issues in Biomedical Research - Cloning and Stem Cell Research - Neuro Ethics - Organ Transplantation - Hypothetico-Deductive Method - Research Conflict of Interest - Medical Device Failure - Five Failure Types - Bio-Terrorism - Sustainable Bioethics - Life cycles and Concurrent Engineering - Environmental Health - Case Studies 9

UNIT 3 MEDICAL DEVICE SAFETY

Shared Responsibility for Medical Device Safety - WHO - International Health Regulations (IHR) -Stages of Regulatory Control of Medical devices - Ethics Committee - its Members and Functions, Global Harmonization Task Force (GHTF) - Quality Systems Requirement - ISO - Voluntary and Mandatory Standards - Collateral Standards - EMC Radiation Protection & Programmable Medical Device System - Particular Standards - Type of Medical Device

9 UNIT 4 REGULATORY STANDARDS FOR MEDICAL DEVICE MAINTENANCE

International Standards - Medical Device Directive 93/42/EEC - Medical Electrical Equipment ISO 60601 - Safety Testing of Medical Devices ISO 62353 - Medical Device Inspection ISO17020 - Indian Standards - National Health Mission - Biomedical Equipment Management and Maintenance Program (BMMP) - ISO 9001-2008 - AERB Compliance - Radiation Protection AE(RP)R-2004 - Safety Code AE/RF-MED/SC-3.

UNIT 5 HOSPITAL ACCREDITATION AND SAFETY STANDARDS

Accreditation - JCI Accreditation & its Policies - Life Safety Standards - Protecting Occupants -Protecting the Hospital and Individuals from Fire, Smoke, and Heat - Managing Hazardous Medical Material and Waste - Laboratory and Radiation safety - Health and Safety Hazards of Shift Work -Patient Safety - Human Factors - Reliability - Evidence Based Medicine - Root Cause Analysis.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. William Charney, "Handbook of Modern Hospital Safety", CRC Press, 2nd Edition, 2009
- Almira Badnjevic, Mario Cifrek, Ratko Magjarevic, Zijad Dzemic, "Inspection of Medical 2. Devices: For Regulatory Purposes", Springer Nature, 2nd Edition, 2023.
- Domiel A Vallero, "Biomedical Ethics for Engineers", Elsevier Pub.1st Edition, 2007. 3.

REFERENCES:

- Eileen E. Morrison, "Ethics in Health Administration: A Practical Approach for Decision 1. Makers", Jonnes and Bartletts' Publication, 2nd Edition, 2019.
- Robert M Veatch and Laura K. Guidry-Grimes "The Basics of Bio Ethics", Routledge, 4th 2.

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Edition, 2019.

- Thomas J. Huser and Brad Keyes, "Physical Environment Online: A Guide to The Joint 3. Commission's Safety Standards", HCPro, Inc., 2010.
- 4. Joint Commission Accreditation Standards for Hospitals and Academic Medical Centers, 8th Edition. 2023.

e-Resources:

- 1. https://www.udemy.com/course/probity-and-ethics-for-healthcare-professionals/, "Probity and Ethics for Healthcare Professionals", by Dr.N.Kumar.
- 2. https://www.udemy.com/course/ethics-and-ethical-standards-for-uk-healthcareprofessional/?couponCode=ST15MT31224, "Ethics and Ethical Standards for HCPs with Evaluation", by Dr.N.Kumar.

Course Outcomes: Upon completion of this course, students will be able to:

- **CO1** Identify the scope of medical ethics
- **CO2** Discuss social responsibility in healthcare systems
- Recommend the suitable principles of medical equipment safety standards in hospitals CO3
- Outline the standards for Medical device maintenance. **CO4**
- Explain hospital accreditation and safety standards CO5

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	2	-	-	3	1	3	-	-	-	1	1	-
CO 2	3	-	2	-	-	3	1	3	-	-	-	1	1	-
CO 3	3	-	2	-	-	3	1	2	-	-	-	1	1	-
CO 4	3	-	2	-	-	3	1	2	-	-	-	1	1	-
CO 5	3	-	2	-	-	3	1	2	-	-	-	1	1	-
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Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Preamble

This course enables the students to learn the history of the forensic sciences and its place in popular culture, roles of different types of professionals involved in evaluating a crime scene and the collected evidence, forensic microscope and Anthropology, Blood stain identification and the methodology of collecting & interpreting data for fingerprint application.

UNIT 1 BASICS OF FORENSIC SCIENCE

Introduction to the Forensic Sciences - History and Development of Forensic Science - Deductive Reasoning - Organization of Crime Laboratory Case Studies: The Enrique Camarena Case - A Forensic Nightmare Organization of Forensic Science Laboratories of Center and State - NCRA and NICFS -Fundamental Rights - Criminal Profiling - Concept of Quality Control Management in Forensic Institutions.

UNIT 2 OBSERVATION AND CRIME SCENE

Observational Skills - Sherlock Holmes and Deductive Reasoning - Observations by Witnesses - Case Studies - The Crime Scene - Locard's Exchange Principle - Securing and Recording the Crime Scene -Legal Considerations at the Crime Scene - Evidence Collection and Recordation Techniques - Mock Crime Scene: Processing and Documenting a Crime Scene.

UNIT 3 FORENSIC MICROSCOPE AND ANTHROPOLOGY

Forensic Use of the Microscope - Compound, Comparison, and Stereoscopic Microscope - The Scanning Electron Microscope (SEM) - Forensic Anthropology- Introduction, Human Anatomy - The Skeletal System - Skeletal Determination of Demographic Data from Skeletal Remains - Determining Types of Trauma and Disease from Skeletal Remains - Case Studies.

UNIT 4 BLOOD STAIN IDENTIFICATION

Detection and Identification of Blood stains - Determination of Species of Origin, Blood Group Systems, Techniques of Determination of Blood groups of Blood Stains - Determination of Seminal and other Fluids and their Blood Grouping – DNA - DNA Phenotyping and RNA Profiling & their applications -Wildlife forensics.

UNIT 5 FINGERPRINT APPLICATION

Fingerprints -Fundamental Principles of Fingerprint Analysis - Classification of Fingerprints - Collection of Fingerprint Evidence - Automated Fingerprint Identification Systems (AFIS) - Track marks - Case Studies.

TEXT BOOKS:

- Nanda, B.B. and Tewari, R.K., "Forensic Science in India: A Vision for the Twenty First Century" 1. Select Publisher, New Delhi, 2014.
- James, S.H and Nordby, J.J., "Forensic Science: An Introduction to Scientific and Investigative 2. Techniques" CRC Press, 4th Edition, 2015.

REFERENCES:

- Richard Saferstein, "Criminalistics: An Introduction to Forensic Science", Pearson; 12th Edition, 1. 2017.
- Sharma, B.R., "Forensic Science in Criminal Investigation and Trials, Central Law Agency", 2. Allahabad, 6th Edition, 2019.
- Deforest, Gansellen & Lee, "Introduction to Criminalistics", McGraw-Hill, 1983. 3.

TOTAL : 45 PERIODS

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e-Resources:

- https://onlinecourses.swayam2.ac.in/cec20_ge10/preview, "Introduction of Forensic Science 1. Services & Police Organization", by Prof. Devasish Bose, Dr. Harisingh Gour Vishwavidyalaya, Sagar M.P.
- https://www.coursera.org/learn/forensic-science, "Introduction of Forensic Science", by Roderick 2. Bates
- Course Outcomes: Upon completion of this course, students will be able to:
- Explain the significance of forensic sciences CO1
- Interpret and document crime scenes CO2
- CO3 Determine Trauma and Diseases
- Describe the various sources of medical data related to forensic science CO4
- CO5 Demonstrate the visual analytical procedure of finger print application

PO 1	PO 2	PO 3	РО 4	РО 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
3	1	1	-	-	1	-	1	-	-	-	-	1	1
3	1	1	-	-	1	-	1	-	-	-	-	1	1
3	1	1	-	1	1	-	1	-	-	-	-	1	1
3	1	1	-	1	1	-	1	-	-	-	-	1	1
3	1	1	-	1	1	-	1	-	-	-	-	1	1
	PO 1 3 3 3 3 3 3 3	PO PO 1 2 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1	PO PO PO 1 2 3 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1 3 1 1	PO PO PO PO 1 2 3 4 3 1 1 - 3 1 1 - 3 1 1 - 3 1 1 - 3 1 1 - 3 1 1 - 3 1 1 - 3 1 1 - 3 1 1 -	PO PO PO PO PO 1 2 3 4 5 3 1 1 - - 3 1 1 - - 3 1 1 - 1 3 1 1 - 1 3 1 1 - 1 3 1 1 - 1 3 1 1 - 1 3 1 1 - 1	PO PO<	PO PO<	PO PO<	PO PO<	PO PO<	PO PO<	PO PO<	PO PO<

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Pre-requisites : Nil

Preamble

This course enables students to explain the techniques used in statistical and regression analysis and compare the various parameters used in statistical significance.

BIOSTATISTICS

UNIT 1 INTRODUCTION

Introduction - Some basic concepts - Measurement and Measurement Scales - Simple random sample, Computers and biostatistical analysis - Introduction to probability - likelihood & odds - distribution variability.

UNIT 2 STATISTICAL PARAMETERS

Statistical parameters p-values - Ccomputation - Level chi square test and distribution - Chi-Square Statistic - Hypothesis Testing–single population proportion - Difference between two population proportions - Single population variance - Ratio of two population variances and tests of goodness of fit - Tests of homogeneity - Tests of independence - Case Study: Effect of Chronic Diseases and Recovery from Covid 19.

UNIT 3 REGRESSION ANALYSIS

Introduction - Regression model - Sample regression equation - Evaluating the regression equation using the regression equation - Correlation model - Correlation coefficient.

UNIT 4 INTERPRETING DATA

Interpreting life tables clinical trials - Epidemical reading and interpreting of epidemical studies - Application in community health.

UNIT 5 META ANALYSIS

META analysis for research activities - Purpose and reading of META analysis - Data used for META analysis - Randomized design–Randomized complete block design - Repeated measures design - Factorial experiment - Case Study: Meta-analysis in medical research.

TEXT BOOKS:

- 1. Brian Williams, "Biostatistics: Concepts and Applications for Biologists", CRC Press, 1st Edition, 2017
- 2. Gerald van Belle, Lloyd D. Fisher, Patrick J. Heagerty, and Thomas Lumley, 'Biostatistics: A Methodology for the Health Sciences', John Wiley & Sons, 2004.

REFERENCES:

- 1. Bernard Rosner, "Fundamentals of Biostatistics", Cengage Learning, 7th Edition, 2015.
- 2. Dr.Indranil Saha, "Biostatistics", Academic Publishers, 2010.
- 3. Ray M. Merrill, 'Fundamentals of Epidemiology and Biostatistics, Jones & Bartlett Learning, 1st Edition, 2013.

e-Resources:

- 1. <u>https://archive.nptel.ac.in/courses/102/101/102101056/</u> "Introduction to Biostatistics", Prof. Shamik Sen , IIT Bombay.
- 2. <u>https://onlinecourses.nptel.ac.in/noc23_bt13/preview</u>, "Biostatistics and Design of experiments", Prof. Mukesh Doble, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain strengths and limitations of measures of central tendency and measures of variability.

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TOTAL: 45 PERIODS

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- CO2 Classify common statistical tests and tools.
- CO3 Distinguish between p-values and confidence intervals as measures of statistical significance.
- CO4 Interpret commonly used regression analysis.
- CO5 Evaluate commonly used statistical and epidemiologic measures.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	-	-	-	1	-	1	1	-	1	1	1	-
CO 2	3	2	-	-	-	1	-	1	1	-	1	1	1	-
CO 3	3	2	-	-	-	1	-	1	1	-	1	1	1	-
CO 4	3	2	-	-	-	1	-	1	1	-	1	1	1	-
CO 5	3	2	-	-	-	1	-	1	1	-	1	1	1	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No

DIGITAL HEALTHCARE TECHNOLOGIES

Pre-requisites : Nil

Preamble

This course enables the students to learn the concepts in digital healthcare and digital hospitals. It develops skills of a student to apply interdisciplinary software and hardware tools in design, testing and developing digital healthcare equipment.

UNIT 1 DIGITAL HEALTH

Digital Health: Requirements and Best Practices, Laws and Regulations in Digital Health, Ethical Issues, Barriers and Strategies for Innovation.

UNIT 2 DIGITAL RADIOLOGY

Digital Radiology for Digital Hospital - Picture Archiving and Communication - System Integration - Digital History of Radiology - Medical Image Archives - Storage and Networks.

UNIT 3 E-HEALTH

E-Health: Health Care Networking, Medical Reporting using Speech Recognition, Physiological Tests and Functional Diagnosis with Digital Methods, Tele-Consultation in Medicine and Radiology.

UNIT 4 M-HEALTH CARE AND WEARABLE DEVICES

Introduction to Mobile Healthcare Devices - Economy - Average Length of Stay in Hospital - Outpatient Care - Health Care Costs - Mobile Phones - 4G - Smart Devices - Wearable Devices - Uptake of E-Health and M-Health Technologies - Standards - System Design - Case Study

UNIT 5 MODALITY AND STANDARDS FOR INTER-OPERABILITY

Multimodality Registration in Daily Clinical Practice - Mobile Healthcare - Selection and Implementation in E-Health Project - Design of Medical Equipment based on User Needs - Security and Privacy In Digital Health Care - Case Study.

TEXT BOOKS:

- 1. Christoph Thuemmler, Chunxue Bai, "Health 4.0: How Virtualization and Big Data are Revolutionizing Healthcare", Springer, 1st ed. 2017
- 2. Wlater Hruby, "Digital Revolution in Radiology Bridging the future of health care, second edition, Springer, New York. 2006
- 3. Samuel A. Fricker, Christoph Thümmler, Anastasius Gavras, "Requirements Engineering For Digital Health", Springer, 2016

REFERENCES:

- 1. Rick Krohn, David Metcalf and Patricia Salber, "Health-e Everything: Wearables and The Internet of Things for Health", Kindle Edition, 2016.
- 2. Khandpur,R.S, "Handbook of Biomedical Instrumentation ", Tata Mc Graw Hill Pub. Co., Ltd., 3rd Edition, 2014.
- 3. John G. Webster and Amit J. Nimunkar, "Medical Instrumentation: Application and Design, Wiley Publisher, New Delhi, 5th Edition, 2020.

e-Resources:

- 1. <u>https://www.coursera.org/specializations/digitalhealth</u>, "Digital Health", by Lisa Danquah
- 2. <u>https://www.coursera.org/learn/ehealth</u>, "eHealth", by Tim Shaw

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Interpret the need for digital methods of handling medical records

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TOTAL : 45 PERIODS

- CO2 Explain the digital radiology
- Modify the tools and methods for work flow in E-Health CO3
- CO4 Identify the available technology for wearable healthcare devices
- Compare various standards for inter-operability of devices, quality and safety standards for CO5 developing healthcare systems

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	1	-	-	-	-	-	-	-	1	3
CO 2	3	2	1	1	1	-	-	-	-	-	-	-	1	3
CO 3	3	2	1	1	1	-	-	-	-	-	-	-	1	3
CO 4	3	2	1	1	1	-	-	-	-	-	-	-	1	3
CO 5	3	2	1	1	1	-	-	-	-	-	-	-	1	3

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

BIOSIGNAL PROCESSING

Pre-requisites : Nil

Preamble

This course provides an introduction to the basic concepts of signal processing methods and to acquire knowledge of analysis of bio signal systems using various transformation techniques. It provides students to realize about different filter structure and also to develop algorithm for signal processing.

UNIT 1 INTRODUCTION TO BIOMEDICAL SIGNALS

Nature of Biomedical Signals - Example of Biomedical Signals: Action Potential- Electroneurogram (ENG) - Electromyogram (EMG) - Electro Cardiogram (ECG) - Electroencephalogram (EEG) -Electrogastrogram (EGG) - Phonocardiogram (PCG) - CP and Speech Signals - Objectives of Biomedical Signal Analysis – Difficulties in Biomedical Signal Analysis.

UNIT 2 NEUROLOGICAL SIGNAL PROCESSING

Electroencephalogram Signal and its characteristics - EEG analysis - Parametric Model -Phenomenological Model –Linear prediction theory – Spectral error measure –EEG Segmentation.

UNIT 3 CARDIOLOGICAL SIGNAL PROCESSING

Introduction - ECG Data acquisition - ECG Parameters and their Estimation: ECG ORS Detection Techniques - Template QRS Detection Technique - Differentiation based QRS Detection Technique -Arrhythmia Analysis Monitoring – Long term continuous ECG recording.

UNIT 4 ADAPTIVE FILTERING AND NOISE CANCELLATION

Introduction – Principle of an adaptive filter – the Steepest Descent Algorithm – The Widrow-Hoff Least Mean Square (LMS) Adaptive Algorithm – LMS Algorithm for the Scalar (One weight) Case – Adaptive Noise Cancelling: Adaptive noise canceller – Cancellation of 60Hz interference in electrocardiography. Cancellation of the electrocardiographic signal from the electrical activity of the chest muscles.

UNIT 5 ANALYSIS OF NONSTATIONARY SIGNALS

Illustration of the problems with case studies - Heart Sound and murmurs- EEG rhythms and waves -Articular cartilage damage and knee joint vibrations - Characterization of nonstationary signals and dynamic systems - Use of Adaptive filters for segmentation - Monitoring the RLS filter - RLSL algorithm for adaptive segmentation – Applications.

TEXT BOOKS:

- 1. Reddy D C, "Biomedical Signal Processing –Principles and Techniques", The McGraw Hill Publishing Company Limited, New Delhi, Reprint 2016.
- 2. Rangaraj M Rangayyan, "Biomedical Signal Analysis A Case Study Approach" (IEEE Press Series on Biomedical Engineering) Edition: 1, John Wiley, 2022.

REFERENCES:

- 1. Rangaraj M Rangayyan, Sridhar Krishnan, "Biomedical Signal Analysis", IEEE Press, Wiley Blackwell, 2023.
- 2. Jose Maria Giron-Sierra "Digital Signal Processing with MATLAB Examples" Springer Nature Singapore, 2017.
- 3. Bruce E N, "Biomedical Signal Processing and Signal Modelling", Wiley India Private Limited, New Delhi, 2007.

e-Resources:

Total: 45 Periods

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- https://ocw.mit.edu/courses/hst-582j-biomedical-signal-and-image-processing-spring-2007/ "Biomedical Signal and Image Processing", Dr.Julie Greenberg, Massachusetts Institute of Technology.
- 2. http://bmsp-coep.vlabs.ac.in/#, "Biomedical and Signal Processing Laboratory", College of Engineering, Pune.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Discuss the different types of biomedical signals and identify their spectral components.
- CO2 Apply established engineering methods to analyses neurological signals.
- CO3 Identify physiological interference and artifacts affecting ECG Signals
- CO4 Explain the adaptive filtering method on biomedical signals and noise cancellation performance.
- CO5 Analyze nonstationary biomedical signals through advanced techniques.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO 2	3	2	1	-	-	1	-	-	1	1	-	2	-	2
CO 3	3	2	1	-	-	2	-	-	1	1	-	2	-	2
CO 4	3	2	1	-	-	2	-	-	2	1	-	2	-	2
CO 5	3	2	1	-	-	2	-	-	1	1	-	2	-	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

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Pre-requisites : BIOSIGNAL PROCESSING

Preamble

This course introduces the fundamentals of speech and audio signal processing, focusing on the analysis, synthesis, and manipulation of speech and audio signals. It covers the theory, algorithms, and practical applications of signal processing techniques used in various domains, such as telecommunications, multimedia systems, speech recognition, and audio processing. Students will gain a solid understanding of the principles and techniques used in speech and audio signal processing, as well as hands-on experience with relevant software tools.

UNIT 1 MECHANICS OF SPEECH AND AUDIO

Introduction – Review of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking – Non simultaneous Masking – Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing – The perceptual audio quality measure (PAQM) – Cognitive effects in judging audio quality.

UNIT 2 TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS

Introduction –Analysis-Synthesis Framework for M-band Filter Banks– Filter Banks for Audio Coding: Design Considerations – Quadrature Mirror and Conjugate Quadrature Filters– Tree- Structured QMF and CQF M-band Banks – Cosine Modulated "Pseudo QMF" M-band Banks – Discrete Fourier and Discrete Cosine Transform – Pre-echo Distortion– Pre-echo Control Strategies.

UNIT 3 AUDIO CODING AND TRANSFORM CODERS

Lossless Audio Coding–Lossy Audio Coding– ISO–MPEG–1A–Dolby Audio Coding Standards–Dolby AC-2, AC-2A– Optimum Coding in the Frequency Domain – Perceptual Transform Coder – Brandenburg-Johnston Hybrid Coder – CNET Coders – Adaptive Spectral Entropy Coding –Differential Perceptual Audio Coder – DFT Noise Substitution –DCT with Vector Quantization–MDCT with Vector Quantization.

UNIT 4 TIME AND FREQUENCY DOMAIN

Time domain parameters of Speech signal – Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods

UNIT 5 LINEAR PREDICTIVE ANALYSIS

Formulation of Linear Prediction problem in Time Domain – Basic Principle of Linear Predictive Analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive solution for the Autocorrelation Equation– lattice formation and solutions – Comparison between the methods of solution of the LPC Analysis Equation – Application of LPC parameters –VELP.

Total : 45 Periods

TEXT BOOKS:

- 1. Rabiner. L. R and Schaffer. R. W., "Digital Processing of Speech signals", Prentice Hall, 1978
- 2. Andreas Spanias, Ted Painter, Venkatraman AttiWayne Tomasi, "Audio signal processing and coding", John Wiley & Sons, 2007

REFERENCES:

- Udo Zölzer, Digital Audio Signal Processing, A John Wiley& sons Ltd Publication, Second 1 Edition. 2008.
- 2. Mark Kahrs, Karlheinz Brandenburg, "Applications of Digital Signal Processing to Audio And Acoustics", KLUWER ACADEMIC PUBLISHERS NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW, 2002.
- Jagdish Chaturvedi, Inventing medical devices: A perspective from India, Create Space 3. Independent Publishing Platform, 1st edition, 2015.

e-Resources:

- https://onlinecourses.nptel.ac.in/noc22_ee117/preview, "Digital Speech Processing" By Prof. 1. Shyamal Kumar Das Mandal, IIT Kharagpur.
- 2. https://www.ee.iitb.ac.in/student/~daplab/, "Digital Audio Processing Lab".

Course Outcomes: Upon completion of this course, students will be able to:

- Examine auditory models to design perceptual audio quality measure. CO1
- CO₂ Design analysis-by-synthesis model for speech perception.
- Analyze and design algorithms for speech and audio coding. CO3
- Analyze and design algorithms for extracting parameters from the speech signal. CO4
- Implement pitch detection and formant analysis in speech signals. CO5

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2		
CO 1	3	2	1	1	2	-	-	-	-	-	-	-	1	-		
CO 2	3	2	1	1	2	-	-	-	-	-	-	-	1	-		
CO 3	3	2	1	1	2	-	-	-	-	-	-	-	1	-		
CO 4	3	2	1	1	2	-	-	-	-	-	-	-	1	-		
CO 5	3	2	1	1	2	-	-	-	-	-	-	-	1	-		
1. Slight (Low) 2. Moderate (Medium)						<u> </u>	2. Substantial (High) " " No completion									

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

COMPUTER VISION

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Pre-requisites : Nil

Preamble

The Course enables the students to understand the fundamental concepts related to multi-dimensional signal and image processing feature extraction, pattern analysis visual geometric modeling and stochastic optimization. It provides students to realize about different models for detection and recognition for developing algorithms.

UNIT 1 IMAGE PROCESSING FOUNDATIONS

Review of image processing techniques – classical filtering operations –Image Restoration-Blur Identification- Superresolution method. Image Segmentation- Watershed method, k-means clustering method–Topological Derivativebased segmentation.

UNIT 2 SHAPES AND REGIONS

Binary shape analysis – connectedness – object labeling and counting – size filtering – distancefunctions skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shapemodelsandshaperecognition–centroidalprofiles–handlingocclusion–boundarylengthmeasures boundarydescriptors – chain codes – Fourier descriptors – region descriptors –moments.

UNIT 3 HOUGH TRANSFORM

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location

UNIT 4 3D VISION AND MOTION

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture –shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle Adjustment – translational alignment – parametric motion – spline-based motion.

UNIT 5 APPLICATIONS

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion–combine views from multiple cameras–humangaitanalysis Application- In-vehicle vision system.

TEXT BOOKS:

- 1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Science & Business Media, 2010
- 2. Rajalingappaa Shanmugamani, "Deep Learning for Computer Vision", Springer Science & Packt Publishing Ltd, 2018.
- 3.

REFERENCES:

- 1. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 1st Edition, 2012.
- 2. Jason Brownlee, "Deep Learning for Computer Vision: Image Classification, Object Detection, and Face Recognition in Python", Edition: v1.7, Machine Learning Mastery, 2019.

e-Resources:

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Total: 45 Periods

- NPTEL Videos https://www.youtube.com/watch?v=7xKhYfPel9w, "Image Segmentation", Prof. P.K. Biswas, Department of Electronics & Electrical Communication Engineering, IIT Kharagpur.
- 2. NPTEL Videos http://www.digimat.in/nptel/courses/video/117105135/L57.html, "Hough Transform", Prof. Prabir umar biswas, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Implement fundamental image processing techniques required for edge and point detection.
- CO2 Compute shapes, contours and boundary features from the detected image and represent the regions using chain codes and Fourier descriptors.
- CO3 Apply Hough Transform to detect lines, circles and ellipses for human iris images.
- CO4 Contrast the shape from texture, focusing and shading and apply reconstruction techniques to the image.
- CO5 Develop algorithms for face detection, recognition and human gait analysis.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	-	-	-	-	-	1	-
CO 2	3	2	1	1	2	-	-	-	-	-	-	-	1	-
CO 3	3	2	1	1	2	-	-	-	-	-	-	-	1	-
CO 4	3	2	1	1	2	-	-	-	-	-	-	-	1	-
CO 5	3	2	1	1	2	-	-	-	-	-	-	-	1	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: M

2: Moderate (Medium)

3: Substantial (High)

MEDICAL IMAGING SYSTEMS

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Pre-requisites : Nil

Preamble

Medical image system provides an introduction to the basic concepts of image processing methods and to acquire knowledge of processing of digital and medical images using various transformation techniques. It provides students to realize about different filters and to develop algorithms for image processing. In order to understand the analysis of entire image in frequency domain it is essential to learn the various image transforms. Also, it is necessary to learn the concepts of image enhancement, segmentation and compression.

UNIT 1 X RAYS

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – XRay 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 2 COMPUTED TOMOGRAPHY

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 rojection and iterative method.

UNIT 3 MAGNETIC RESONANCE IMAGING

Fundamentals of magnetic resonance- properties of electromagnetic waves : speed , amplitude, phase, orientation and waves in matter - 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 Superconductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT 4 NUCLEAR IMAGING

Radioisotopes- 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, and photomultiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET.

UNIT 5 RADIATION THERAPY AND RADIATION SAFETY

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

Total : 45 Periods

TEXT BOOKS:

1. Isaac Bankman, I. N. Bankman, Handbook Of Medical Imaging: Processing and Analysis(Biomedical

Engineering), Academic Press,2000.

 Jacob Beutel (Editor), M. Sonka (Editor), Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis, SPIE Press 2000.

REFERENCES:

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- 1. Khin Wee Lai, DyahEkashantiOctorinaDewi "Medical Imaging Technology", Springer Singapore, 2015.
- 2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.
- Dougherty, Geoff (Ed.), "Medical Image Processing Techniques and Applications ",Springer-Verlag New York, 2011

e-Resources:

- 1. NPTEL Video https://nptel.ac.in/courses/117105079/ "Introduction to Digital Image System", Prof. Prabir Kumar Biswas, IIT Kharagpur.
- 2. NPTEL Video https://www.digimat.in/nptel/courses/video/108105091/L01.html"Introduction to Medical

Image Analysis", Prof.Debdoot Sheet, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Describe the working principle of the X-ray machine and its application.

- CO2 Illustrate the principle computed tomography.
- CO3 Interpret the technique used for visualizing various sections of the body using Magnetic Resonance Imaging.
- CO4 Demonstrate the applications of radionuclide imaging.
- CO5 Analyze different imaging techniques and choose appropriate imaging equipment for better Diagnosis and outline the methods of radiation safety.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	РО 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 3	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 4	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO 5	3	2	1	1	-	-	-	-	-	-	-	-	1	-
1: Slight (Low) 2: Moderate (Medium))	3: Sul	bstanti	al (Hig	gh)	"-" No correlation				

Mapping of COs with POs and PSOs

22MDE55 BRAIN COMPUTER INTERFACE AND ITS APPLICATIONS L T P C

Pre-requisites : Nil

Preamble

This course introduces the basic concepts of brain computer interface and provides knowledge about the signal processing methods used in brain computer interface.

UNIT 1 INTRODUCTION TO BCI

Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, , Non-invasive and Partially invasive BCI- Brain signal acquisition, Signal Preprocessing, Artifacts removal.

UNIT 2 ELECTROPHYSIOLOGICAL SOURCES

Sensorimotor activity –Neuronal activity in motor cortex and related areas- Electric and magnetic fields produced by the brain- signals reflecting brain metabolic activity–Mu rhythm–Movement Related Potentials–SlowCorticalPotentials-P300Eventrelatedpotential–VisualEvokedPotential-Activity of Neural Cells – Multiple Neuro-mechanisms.

UNIT 3 FEATURE EXTRACTION METHODS

Time/Space Methods – Fourier Transform–Wavelets– AR, MA, ARMA models, Bandpass filtering, Template matching–Kalman filter–PCA– Laplacian filter – Linear and Non-Linear Features.

UNIT 4 FEATURE TRANSLATION METHODS

Linear Discriminator Analysis –Nearest neighbors– Support Vector Machines – Regression –Learning Vector Quantization – Gaussian Mixture Modeling – Hidden Markov Modeling – Neural Networks.

UNIT 5 APPLICATIONS OF BRAIN-COMPUTER INTERFACES

Functional restoration using Neuroprosthesis –Functional Electrical Stimulation–Visual Feedback and control –External device control–Case study: Brain actuated control of mobile Robot.

TEXT BOOKS:

- 1. Claude Clement, "Brain-Computer Interface Technologies: Accelerating Neuro-Technology for Human Benefit", Springer Nature, 2019.
- 2. Aboul Ella Hassanien, Ahmad Taher Azar, "Brain-Computer Interfaces: Current Trends and Applications"Springer, 2014.

REFERENCES:

- 1. MaureenClerc, "Brain-ComputerInterfaces:MethodsandPerspectives", JohnWiley&Sons, 2016.
- 2. Nick F.Ramsey, "Brain-Computer Interfaces", John Wiley & Sons, 2020.

e-Resources:

- 1. https://www.emotiv.com/bci-guide/ "The Introductory Guide to BCI".
- 2. https://nptel.ac.in/courses/106/105/106105215/ " Deep Learning", Prof. Prabir Kumar Biswa, Department of Electronics and Elecrical Communication Engineering, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Discuss the basic concepts of brain computer interface.
- CO2 Summarize the various signal acquisition methods.
- CO3 Summarize the various signal acquisition methods.

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Total: 45 Periods

- CO4
- Design classifier for a BCI system. Implement BCI for various applications. CO5

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 2	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 3	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 4	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 5	3	2	1	1	2	-	-	-	-	-	-	-	-	-
1: Slight (Low) 2: Moderate (Medium))	3: Sul	bstanti	al (Hi	gh)	"-" No correlation			

Mapping of COs with POs and PSOs

5/13/2024

BIOMETRIC SYSTEMS

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Pre-requisites : Nil

Preamble

This course provides the students to get knowledge on the technologies involved in fingerprint, iris, face and speech recognition. It also enables the students to recognize personal privacy and security implications in biometric based identification system to develop biometric systems by minimizing the underlying trade-offs.

UNIT 1 INTRODUCTION TO BIOMETRICS

Biometric Technologies– passive and active biometrics– Biometrics and traditional techniques. Biometric characteristics– Biometric applications – Biometric Authentication systems- Taxonomy of Application Environment– Performance and Accuracy measures in Biometric Systems–False match rate-False nonmatch rate- Failure to enroll rate– Derived metrics-Biometrics and Privacy.

UNIT 2 FINGERPRINT IDENTIFICATION TECHNOLOGY

General description of fingerprints- fingerprint capture & sensors- fingerprint enhancement- Feature Extraction- Ridge orientation- ridge frequency- fingerprint matching techniques- correlation based- Minutiae based- Ridge feature based- fingerprint classification- Applications of fingerprints- Finger scan - strengths and weaknesses- Evaluation of fingerprint verification algorithms. Fingerprints in forensics and biometrics- similarities and differences

UNIT 3 FACE RECOGNITION

Introduction to face recognition– face recognition using PCA– LDA– face recognition using shape and texture– face detection in color images–3Dmodel based face recognition in video images– Neural networks for face recognition– Hand geometry – scanning – Feature Extraction – classification.

UNIT 4 IRIS RECOGNITION

Introduction– Anatomical and Physiological underpinnings– Iris sensor– Iris representation and localization– Daugman and Wilde's approach– Iris matching– Iris scan strengths and Weaknesses– System performance– futuredirections

UNIT 5 VOICE SCAN AND MULTIMODAL BIOMETRICS

Voice scan speaker features, short term spectral feature extraction, Mel frequency cepstral coefficients, speaker matching, Gaussian mixture model, NIST speaker Recognition Evaluation Program, Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy, examples of multimodal biometric systems.

TEXT BOOKS:

- 1. James Wayman& Anil Jain, "Biometric Systems- Technology Design and Performance Evaluation", Springer, First Edition, 2011.
- 2. John R. Vacca, "Biometric Technologies and Verification Systems", First Edition Elsevier, 2007.

REFERENCES:

- 1. G.R.Sinha, Sandeep B.Patel, "Biometrics: Concepts and Applications", Wiley Publications, First edition, 2013
- 2. Paul Reid, "Biometrics for Network Security", Pearson Education, 2004.
- 3. Kisku, Dakshina Ranjan, Gupta, Phalguni, Sing, Jamuna Kanta, "Design and Implementation of Healthcare Biometric Systems", IGI Global, 2019

e-Resources:

1. NPTEL Video https://nptel.ac.in/courses/106/104/106104119/ "Biometrics ",Prof. Phalguni Gupta,

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Total: 45 Periods

IIT Kanpur.

2. https://ieeexplore.ieee.org/document/8851272/ Libing Wu, IEEE Transactions onInformation Forensics and Security.

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Demonstrate the knowledge on principles of biometrics system.
- CO2 Understand the feature extraction, classification techniques and applications of fingerprint technology.
- CO3 Discuss about the techniques involved in face recognition biometric system.
- CO4 Design iris recognition system.
- CO5 Develop speech recognition and multimodal biometric systems.

COs/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 2	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 3	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 4	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 5	3	2	1	1	2	-	-	-	-	-	-	-	-	-

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

22MDE57 PATTERN RECOGNITION AND NEURAL NETWORKS L T P C

Pre-requisites : Nil

Preamble

This course provides the fundamentals of pattern recognition and its application and imparts knowledge on the Neural network architectures. It also enables the students to realize the learning algorithms to develop applications in pattern recognition, image processing and computer vision.

UNIT 1 INTRODUCTION AND SUPERVISED LEARNING

Applications of Pattern recognition, Random variables, Types of Pattern recognition, Statistical Decision making – Bayes theorem –multiple features-Decision Boundaries - estimation of error rates, Nonparametric Decision making – Histograms – kernels -window estimators - nearest neighbor classification – AdaptiveDecision Boundaries – Adaptive and Minimum Squared error Discriminant functions.

UNIT 2 UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS

Unsupervised learning- Hierarchical clustering- Single-linkage Algorithm, Complete – linkage Algorithm, Average-linkage algorithm and Ward's method. Partitional clustering– Forgy's Algorithm, k-means algorithm and Isodata Algorithm.

UNIT 3 INTRODUCTION AND SIMPLE NEURAL NET

Introduction – Artificial Neural Networks– Biological neural network– Comparison– Basic Building blocks–Terminologies– Fundamental Model of Artificial Neural Networks– Perceptron, Adaline and Madaline.

UNIT 4 BACK PROPAGATION AND ASSOCIATIVE MEMORY

Back propagation network, generalized delta rule, Associative memory Network, Hopfield Network

UNIT 5 NEURAL NETWORKS BASED ON COMPETITION

Kohonen Self organizing map, Learning Vector Quantization, Counter Propagation network.

Total: 45 Periods

TEXT BOOKS:

- 1. Earl Gose, Richard Johnsonbaugh and Stve Jost, "Pattern Recognition and Image analysis", PHI Learning Private Limited, New Delhi, 2009.
- 2. S.N. Sivanandam, S.Sumathi and S.N. Deepa, "Introduction to Neural Networks using MATLAB 6.0", McGraw Hill Education (India) Private Limited, New Delhi, 2006.

REFERENCES:

- 1. Duda R.O. Hart P.G, "Pattern Classification and scene analysis", Wiley Edition 2000.
- 2. Hagan, Demuth and Beale, "Neural network design", Vikas Publishing House Pvt Ltd., New Delhi, 2002.
- 3. Freeman J.A., and Skapura B.M, "Neural Networks, Algorithms, Applications and Programming Techniques", Addison Wesley, 2003.

e-Resources:

- NPTEL Video http://nptel.ac.in/courses/117105101/, "Pattern Recognition and Application", Prof. P. K.Biswas, Indian Institute of Technology, Kharagpur.
- 2. NPTEL Video http://nptel.ac.in/courses/117105084/, "Neural Networks and Applications", Prof.S. Sengupta, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

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- CO1 Explain the basics of pattern recognition.
- CO2 Apply the different pattern recognition techniques to the application of interest.
- CO3 Explain the fundamentals of neural networks.
- CO4 Explain the function of neural networks of the Back-propagation, Hopfield, CPN and SOM.
- CO5 Perform algorithmic training of various neural networks.

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 2	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 3	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 4	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO 5	3	2	1	1	2	-	-	-	-	-	-	-	-	-

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) "-" No correlation

MEDICAL INFORMATICS

Pre-requisites : Nil

Preamble

This course provides knowledge on resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.

UNIT 1 INTRODUCTION TO MEDICAL INFORMATICS

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues, Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics, Bioinformatics

UNIT 2 COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING

Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, ultrasound imaging, computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance.

UNIT 3 COMPUTERISED PATIENT RECORD

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT 4 COMPUTER ASSISTED MEDICAL DECISION-MAKING

Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer–assisted decision support system-production rule system cognitive model, semantic networks, decisions analysis in clinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT 5 RECENT TRENDS IN MEDICAL INFORMATICS

Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and health- Medical education and healthcare information, computer assisted instruction in medicine.

TEXT BOOKS:

- 1. Edward H. Shortliffe, Leslie E. Perreault, "Medical Informatics: Computer Applications in Health Care and Biomedicine", 2nd Edition, Springer 2013.
- 2. Alain Venot, Anita Burgun, Catherine Quantin, Medical Informatics, e-Health: Fundamentals and Applications^{II}, Springer Science & Business Media, 2013
- 3. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Ltd, 2003.
- 4. R.D.Lele, "Computers in medicine progress in medical informatics", Tata Mcgraw Hill,2005

REFERENCES:

- 1. Dinesh Bhatia, "Medical Informatics", PHI Learning Pvt. Ltd., 2015.
- 2. Ken ong, Medical Informatics An executive Premier, 3rd Edition, HIMSS, 2015.
- 3. Kathryn J. Hannah, Marion J Ball, "Health Informatics", 3rd Edition, Springer, 2006.

e-Resources:

1. <u>https://archive.nptel.ac.in/courses/102/106/102106065/</u>, "Concepts and importance of Bioinformatics", Prof.M.Michael Gromiha, IIT Madras.

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TOTAL : 45 PERIODS

2. https://archive.nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge14/, "Regulatory requirements for medical devices and IVDs in India", Dr.Sucheta Banerjee Kurundkar, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

- Explain the structure and functional capabilities of Hospital Information System. CO1
- CO₂ Describe the need of computers in medical imaging and automated clinical laboratory.
- CO3 Articulate the functioning of information storage and retrieval in computerized patient record system.
- Apply the suitable decision support system for automated clinical diagnosis. CO4
- CO5 Discuss the application of virtual reality and telehealth technology in medical industry.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 2	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 3	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 4	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 5	3	2	1	1	2	-	-	1	-	-	-	-	1	1
1. Slight (Low) 2. Moderate (Medium)							3. 511	hstanti	al (Hi	oh)	"_" N	Jo cor	relation	,

Mapping of COs with POs and PSOs

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation WEARABLE DEVICES

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Pre-requisites : Nil

Preamble

The Course enables the students to study about communication, security aspects and applications of wearable devices in the field of medicine

UNIT 1 INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS

Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor.

UNIT 2 SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT 3 WIRELESS HEALTH SYSTEMS

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 4 SMART TEXTILE

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques-Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks. Case study-smart fabric for monitoring biological parameters - ECG, respiration.

UNIT 5 APPLICATIONS OF WEARABLE SYSTEMS

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TEXT BOOKS:

- 1. Zhang and Yuan-Ting, Wearable Medical Sensors and Systems, Springer, 2024
- 2. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals, Implementation and Applications, Elsevier, 2014
- 3. Annalisa Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011
- 4. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications, Pan Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCES:

- 1. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkata subramanian, Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.
- 2. Guang-Zhong Yang, Body Sensor Networks, Springer, 2006.

e-Resources:

1. <u>https://nptel.ac.in/courses/108105101</u>, "Biomedical Signal Processing", Prof. Sudipta Mukhopadhyay, IITKGP

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TOTAL : 45 PERIODS

- 2. <u>https://www.researchgate.net/publication/271371231</u>, Wireless_Communication_Technologies _for_Wearable_Systems.
- Course Outcomes: Upon completion of this course, students will be able to:
- CO1 Describe the concepts of wearable system.
- CO2 Explain the energy harvestings in wearable device.
- CO3 Use the concepts of BAN in health care.
- CO4 Illustrate the concept of smart textile.
- CO5 Compare the various wearable devices in healthcare system.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 2	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 3	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 4	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 5	3	2	1	1	2	-	-	1	-	-	-	-	1	1

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

22MDE63

TELEHEALTH TECHNOLOGY

L T P C 3 0 0 3

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Pre-requisites : Nil

Preamble

The Course enables the students to know telemedical standards, telemedical technology, mobile telemedicine and it applications.

UNIT 1 FUNDAMENTALS OF TELEMEDICINE

History of telemedicine, definition of telemedicine, tele-health, tele-care, scope, Telemedicine Systems, benefits & limitations of telemedicine.

UNIT 2 TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR 9 TELEMEDICINE 9

Audio, video, still images, text and data, fax-type of communications and network: PSTN, POTS, ANT, ISDN, internet, air/ wireless communications, GSM satellite, micro wave, Mobile health and ubiquitous healthcare.

UNIT 3 ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE

Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues.

UNIT 4 PICTURE ARCHIVING AND COMMUNICATION SYSTEM

Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT 5 APPLICATIONS OF TELEMEDICINE

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e Health and Cyber Medicine.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. H K Huang, "PACS and Imaging Informatics: Basic Principles and Applications", Wiley, 2nd Edition, 2010.
- 2. Norris A C, "Essentials of Telemedicine and Telecare", John Wileyand Sons, New York, 2002.

REFERENCES:

- 1. Olga Ferrer Roca, Marcelo Sosa Iudicissa, "Handbook of Telemedicine", IOS Press, Netherland, 2002.
- 2. Khandpur R S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 3rd Edition ,2003.
- 3. Keith J Dreyer, Amit Mehta, James H Thrall, "Pacs: A Guide to the Digital Revolution", Springer, New York, 1st Edition 2002.

e-Resources:

- 1. <u>https://</u>Error! Hyperlink reference not valid." Telehealth"
- 2. <u>https://www.youtube.com/watch?v=KYwbkP9bDZA</u> "Telemedicine and health"
- 3. <u>https://www.youtube.com/watch?v=qWaRYw3RI58</u> "Telemedicine Part 1 Basics, Technology, Network and System, Sudhamony S

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Describe the benefits & limitation of telemedicine
- CO2 Identify the need of ICI for telemedicine

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- CO3 Summarize the Ethical and Legal aspects in telemedicine
- Discuss the Picture archiving techniques and technical issues. CO4
- Apply the knowledge in various applications of telemedicine in health care sector. CO5

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	1	-	-	-	-	2	-
CO 2	3	2	1	1	2	-	-	1	-	-	-	-	2	-
CO 3	3	2	1	1	2	-	-	1	-	-	-	-	2	-
CO 4	3	2	1	1	2	-	-	1	-	-	-	-	2	-
CO 5	3	2	1	1	2	-	-	1	-	-	-	-	2	-
1: Slight (Low) 2: Moderate (Medium))	3: Substantial (High) "-" No correlati						relation	ı

Mapping of COs with POs and PSOs

1: Slight (Low)

IoT IN HEALTHCARE

Pre-requisites : Nil

Preamble

This course aims to provide recent advances in IoT for biomedical engineering, biometrics, bioinformatics, artificial intelligence and computer vision. It also imparts knowledge on usage challenges and interoperability issues with respect to the cost and accuracy of medical sensors, non-standard IoT system architectures, , huge volume of generated data in healthcare

UNIT 1 OVERVIEW OF INTERNET OF THINGS

Introduction-Healthcare architecture in Internet of Things-Communication between devices-Medical body area networks-Architecture Requirements-Healthcare Ecosystem– Health Care Applications using IoT– Health Application Requirements– Opportunities And Challenges.

UNIT 2 MEDICAL BIG DATA

Big Data dimensions Big Data for Medical Industry– Information Processing in Health Care Analytics– Data Mining Process for Medical Big Data– Medical Big Data Analytics– Medical Big Data-Applications and Challenges.

UNIT 3 IoT TECHNOLOGIES AND CHALLENGES

IoMT system Architecture– Components of system architecture– IoT Healthcare solutions– Enhanced medicine management– Technologies used in IoT-based applications.

UNIT 4 AI IN BIOMEDICINE

AI and Computer Vision in biomedicine-Principal Disciplines of AI and Computer Vision-Machine learning–Classification and Regression– Predictive Analysis. Biomedical applications and solutions-Medical Imaging– Pattern Recognition– Abnormality Detection.

UNIT 5 IoT IN HEALTHCARE APPLICATIONS

IoT based smart and secure health monitoring system– Development of obstacle avoiding robots based on sensors and IoT– Patient health monitoring system using Arduino and Android– detection of atrial fibrillation– fall detection using IoT technologies.

TEXT BOOKS:

- 1. Valentina E. Balas, Le Hoang Son, "Internet of Things in Biomedical Engineering", Academic Press, 1 st Edition, 2019.
- 2. Chintan Bhatt, Nilanjan Dey, "Internet of Things and Big Data Technologies for Next Generation Healthcare", Springer- Technology & Engineering, 2017.
- 3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "loT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

REFERENCES:

- 1. Nilanjan Dey, Amira S. Ashour, "Wearable and Implantable Medical Devices: Applications and Challenges", Academic Press, 1 st Edition, 2019.
- 2. Singh, Rajesh, Gehlot, Anita, Jain, Vishal, Malik, Handbook of Research on the Internet of Things Applications in Robotics and Automation, IGI Global, 1 st Edition, 2019.
- 3. Jamil Y. Khan, Mehmet R. Yuce, "Internet of Things (IoT): Systems and Applications", CRC Press, 1 st Edition, 2019.
- 4. Venkata Krishna, Sasikumar Gurumoorthy, Mohammad S. Obaidat, "Internet of Things and

TOTAL: 45 PERIODS

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Personalized Healthcare Systems", Springer Briefs in Applied Sciences, and Technology, Forensic and Medical Bioinformatics, 2019.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/106/105/106105166/</u> "Introduction to IoT",Prof.Sudip Misra, IIT Kharagpur.
- 2. Error! Hyperlink reference not valid." Case Study: Healthcare" Prof.Sudip Misra, IIT Kharagpur.
- **Course Outcomes:** Upon completion of this course, students will be able to:
- CO1 Discuss IoT healthcare functional architecture and map its components with respect to requirement analysis and wearable characteristics.
- CO2 Summarize the process of medical big data analytics for diagnosis of abnormalities.
- CO3 Compare the IoMT technologies associated with biomedicine and contrast working methodologies with respect to healthcare.
- CO4 Illustrate artificial intelligence and computer vision techniques employed in biomedical sciences.
- CO5 Design and develop an IoT based health monitoring system using Arduino.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	1	1	1	-	-	-	-	-	-	-	-	1	1
CO 2	3	1	1	1	-	-	-	-	-	-	-	-	1	1
CO 3	3	1	1	1	-	-	-	-	-	-	-	-	1	1
CO 4	3	1	1	1	-	-	-	-	-	-	-	-	1	1
CO 5	3	1	1	1	-	-	-	-	-	-	-	-	1	1

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

"-" No correlation

22MDE65

CLOUD COMPUTING FOR HEALTHCARE

L T P C

Pre-requisites : Nil

Preamble

This course provides understanding about the cloud computing in healthcare applications.

UNIT 1 CLOUD COMPUTING ARCHITECTURE

Cloud Computing at a Glance, The Vision of Cloud Computing, Cloud Computing Reference Model, Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, Cloud ecosystem.

UNIT 2 DISTRIBUTED SYSTEMS AND VIRTUALIZATION

Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Para virtualization, VMware: Full Virtualization, Microsoft Hyper-V.

UNIT 3 CONCURRENT COMPUTING

Thread Programming, Programming Applications with Threads, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent. High-Throughput Computing: Task Programming, Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies.

UNIT 4 DATA INTENSIVE COMPUTING

Map-Reduce Programming, Introduction to Data Intensive Computing - Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application.

UNIT 5 HEALTHCARE APPLICATIONS CASE STUDIES

An Adaptive Cloud Prototype Model for Health Care system using Software Defined Network (SDN), Big Data Analytics for Childhood Pneumonia monitoring, Diabetes, Patient monitoring by Cloud Computing, Trust-Privacy Issues in Cloud Based Healthcare Services.

TEXT BOOKS:

- Chintan M. Bhatt S. K. Peddoju, "Cloud Computing Systems and Applications in Healthcare", 1. 2019.
- 2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi "Mastering Cloud. Computing" McGraw Hill Education, 2016.

REFERENCES:

- Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013 1.
- 2. Derrick Rountree and Ileana Castrillo "The Bascis of Cloud Computing" Springer, 2015

e-Resources:

https://www.digimat.in/nptel/courses/video/106105167/L01.html, Cloud Computing 1. Overview, Prof. soumya kanti ghosh, IIT KARAGPUR

TOTAL : 45 PERIODS

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2. <u>https://nptel.ac.in/courses/106105167</u>, Foundation of Cloud IoT Edge ML Prof. Rajiv Misra | IIT Patna

Course Outcomes: Upon completion of this course, students will be able to:

- CO1 Explain the fundamentals of cloud computing
- CO2 Explain virtualization and Differentiate Various cloud platforms used in industry
- CO3 Illustrate the cloud application programming
- CO4 Describe the platforms for development of cloud applications
- CO5 Apply the technology for healthcare applications

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 2	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 3	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 4	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 5	3	2	1	1	2	-	-	1	-	-	-	-	1	1

Mapping of COs with POs and PSOs

1: Slight (Low)

- 2: Moderate (Medium)
- 3: Substantial (High)

"-" No correlation

22MDE66 AUGMENTED REALITY AND VIRTUAL REALITY IN L T P C

HEALTHCARE

Pre-requisites : Nil

Preamble

The Course enables the students to Understand virtual reality, augmented reality and using them to build Biomedical engineering applications.

UNIT 1 INTRODUCTION

The three I's of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT 2 VR DEVELOPMENT PROCESS

Geometric modeling - kinematics modeling - physical modeling - behaviour modeling - model management.

UNIT 3 CONTENT CREATION CONSIDERATIONS

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment.

UNIT 4 VR ON THE WEB & VR ON THE MOBILE

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics.

UNIT 5 APPLICATIONS

Medical applications-military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy.

TEXT BOOKS:

- C. Burdea & Philippe Coiffet, "Virtual Reality Technology", Second Edition, Gregory, John Wiley & Sons, Inc., 2008
- 2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

REFERENCES:

- 1. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
- 2. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability), Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
- 3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press; 1 edition, 2016.

e-Resources:

- 1. <u>https://nptel.ac.in/courses/106106138</u>, "Virtual Reality", Prof Steven LaValle IIT Madras.
- 2. <u>https://elearningindustry.com/how-vr-and-ar-are-revolutionizing-elearning-for-learners-of-all-ages</u>

Course Outcomes: Upon completion of this course, students will be able to: CO1 Introduce the relevance of this course to the existing technology through demonstrations, case

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TOTAL: 45 PERIODS

studies and applications with a futuristic vision along with socio-economic impact and issues

- CO2 Understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- CO3 Know the intricacies of these platform to develop PDA applications with better optimality.
- CO4 Learn the various applications of VR.
- CO5 Learn the possibilities of implementing target-specific VR applications on mobile

Cos/POs	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 2	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 3	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 4	3	2	1	1	2	-	-	1	-	-	-	-	1	1
CO 5	3	2	1	1	2	-	-	1	-	-	-	-	1	1

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High) "-" No correlation

22MDE67

CYBER SECURITY FOR MEDICAL SYSTEMS

L T P C

Pre-requisites : Nil

Preamble

This course has been developed to raise awareness and understanding the role of cyber security in healthcare and the challenges that surround it. It explains how the rise of technologies and proliferation of medical data has become an attractive target to cyber criminals, which is essential in understanding why adequate Cyber Security measures are critical within the healthcare environment.

UNIT 1 HACKERS RECONNAISSANCE TO HOSPITAL NETWORK

Footprinting - Scanning - Enumeration - Network Mapping - Cyber Threat Actors - Phishing Attack - Email Phishing Attack - Man-in-the-Middle Attack - Pharming Attack - Indirect Cyber Attack - Scareware - Ransomware - USB Stick - Auto-Hacking Attack - Backdoors - Ad Hoc Network - Unpatched Vulnerabilities - Appliance Hacks - Password Cracker - Denial-of-Service Attack - Black Hole Attack - Secondary Entry Points - Modems - Rouge Access Points.

UNIT 2 ACTIVE MEDICAL DEVICE CYBER ATTACKS

Magnetic Resonance Imaging - X-ray Generator - Infusion Pump - Positron Emission Tomography Scanner - X-ray - Computer Tomography Scanner - Medical Ventilator - Anesthetic Machine - Heart-Lung Machine - Extracorporeal Membrane Oxygenation - Dialysis Machine - Medical Lasers - Robotic Surgical Machine - Medical Device Data Systems - Active Patient Monitoring Devices - Interoperable Medical Devices - Medical Laboratory - Electronic Health Records - Barcode Scanning Systems.

UNIT 3 MEDICAL FACILITY CYBER-PHYSICAL ATTACKS

Building Control System (BCS) - Facility Equipment Controlled by the BCS - BCS Network Vulnerabilities - Preventing Hospital Building Equipment Damage - Facility Equipment Cyber-Physical Attacks - Steam Boilers - Boiler Sequence Controller Hack - Hot Water Heater Explosion - Chillers - Cooling Tower - Backup Generator.

UNIT 4 DETECTION AND PREVENTION OF CYBER ATTACKS

Indicators of Possible Cyber Attack - Cyber Attack Detection Tools - Intrusion Detection Systems - Intrusion Detection Systems Alarms - Intrusion Prevention System - Forensic Evidence of a Cyber Attack - Cyber Hygiene - Network Procurement Documentation - Discontinue Remote Connections to the Medical Equipment Network - Implement Application Whitelisting - Systematic Patch Management Regimen - Attack Surface Reduction - Building a Defendable Network Environment – Manage Authentication - Monitor and Respond - Cyber Security Analysis Tools - Phishing Scam Avoidance.

UNIT 5 HOSPITAL INSIDER THREATS & CYBER ATTACK MANGEMENT

Types of Insider Threats - Types of Insider Cyber Attacks - Insider Hacking Tools - Developing a Response and Recovery Plan - Incident Response Team - Recovery Phases - After Action Report - Cyber Attack Response Procedures Chart - Intrusion Detection System Alerts.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1. Luis Ayala, "Cybersecurity for Hospitals and Healthcare Facilities: A Guide to Detection and Prevention", Apress., 2016
- 2. W. Andrew H. Gantt, "Healthcare Cybersecurity", American Bar Association, 2021.

REFERENCES:

- 1. Pierguido Iezzi, "Healthcare Cybersecurity", Youcanprint, 2018.
- 2. Nina Godbole, "Cyber Threats in Healthcare", Wiley, 2021.

e-Resources:

1. https://www.udemy.com/course/h17-cyber-security-in-healthcare-part-1-plain-simple/, "Intro to

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Cybersecurity in Healthcare", by Thomas Giordano.

https://www.coursera.org/learn/cybersecurity-in-healthcare, "Cybersecurity in Healthcare ", by 2. Jason H. Pridmore and Tessa A. P. Oomen.

Course Outcomes: Upon completion of this course, students will be able to:

- Identify possible ways the hackers can hack hospital and healthcare facility equipment CO1
- Summarize the possibilities of weaponization of medical device by hackers CO2
- CO3 Discuss medical facility cyber-physical attacks
- CO4 Detect and prevent cyber attacks
- CO5 Create a response and recovery plan to manage cyber attacks

Cos/POs	PO 1	PO 2	PO 3	РО 4	РО 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	1	-	1	1	-	-	-	-	1	1	2
CO 2	3	2	1	1	-	1	1	-	-	-	-	1	1	2
CO 3	3	2	1	1	-	1	1	-	-	-	-	1	1	2
CO 4	3	2	1	1	-	1	1	-	-	-	-	1	1	2
CO 5	3	2	1	1	-	1	1	-	-	-	-	1	1	2

Mapping of COs with POs and PSOs

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

" No correlation

22MDV01 CLINICAL PATHOLOGY AND MICROBIOLOGY L T P C 0 0 2 1

Prerequisite:

Having basic knowledge on cell degeneration, microorganism and microscopy

Preamble:

To develop the knowledge of clinical laboratory skills and techniques related to the isolation, staining, identification, assessment of metabolism, and control of microorganisms

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Correlate the important clinical features of the disease with the pathologic changes
- 2. Explain the etiology, pathogenesis, gross and microscopic appearances, relevant laboratory investigations, complications and the outcome of common diseases.

Module 1 – Cell Degeneration And Neoplasia

Cell degeneration and regeneration

Hemodynamic derangement

Neoplasia

Module 2 – Microbial Cultures And Staining Techniques

Identification of pathogens in biological sample

Staining methods - simple, gram staining and AFB staining

TOTAL : 30 PERIODS

10

20

REFERENCES:

- 1. Robbins and Cotran Pathologic Basis of Diseases^{II}, 7th edition, Vinay Kumar, Abul K.Abbas, Nelson Fausto, Saunders, An imprint of Elsevier, 2006.WB Saunders Co. 2005.
- 2. Ananthanarayanan and Panicker's Textbook of Microbiology, Edited by C K J Paniker, Orient Longman Private Limited, 2005

- 1. Microbiology and Immunology On -line from the Department of Pathology, Microbiology and Immunology at the University of South Carolina School of Medicine http://pathmicro.med.sc.edu/book/welcome.htm, comprehensive list of lectures, quizzes and other learning material.
- 2. http://emedicine.medscape.com/infectious_diseases, (very comprehensive website listing numerous infectious disease agents, with background, differential diagnoses, treatment and follow up)

and repair modules Engineering World Health, 2020.

22MDV02 CALIBRATION AND TESTING OF MEDICAL DEVICES 0 0 2 1

Prerequisite:

Having a basic knowledge on measurements, errors and calibration techniques in medical devices.

Preamble:

Medical equipment is prone to wear and tear over time, which directly affects the accuracy and performance. To maintain the equipment effectiveness and decrease the risk of causing harm to a patient, periodic calibration is necessary. Regularly calibrating equipment will ensure that industry defined standards are met and that the equipment functional providing accurate output.

Course Outcomes: Upon completion of the course, students will be able to:

- Understand the importance of testing biomedical equipment and the purpose of quality 1. assurance.
- Achieve uniformity in selection of equipment, calibration methods, maintaining required 2. environmental conditions in line with national and international standards.

Module 1 – Calibration and Testing of Medical Device

- Simulation of Biological Signals
- Calibration and Testing of ECG machine
- Electrical Safety & Quality Assurance Electrical Safety Analyzer

Module 2 – Quality Assurance Phantom for Imaging Devices

- Quality Assurance test in X-ray machine
- Designing phantom of various imaging devices

TOTAL: 30 PERIODS

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REFERENCES:

- 1. Joseph. J Carr, John M Brown, "Introduction to Biomedical Equipment Technology", JohnWiley& Sons, New York, 4thedition, 2008.
- 2. Justin Cooper, Alex Dahinten, "Medical Equipment Troubleshooting Flowchart Handbook", Engineering World Health, Version 6, 2013.

e-Resources:

- 1. https://apps.who.int/iris/bitstream/handle/10665/44587/9789241501538 eng.pdf/jsessionid=156 EC3788 A40D9EB8B7E9CD5EAA741BB?sequence=1,"Medical equipment maintenance programme overview".
- 2. https://onlinecourses.nptel.ac.in/noc20 ge14/preview, "Regulatory requirements for medical devices including in vitro diagnostics in India (Version 2.0)", Shri Aseem Sahu, Shri. Malay Mitra, CDSCO, Ministry of Health & Family Welfare, New Delhi.
- 3. https://bmet.ewh.org/handle/20.500.12091/434 , Fault diagnosis

LTPC

22MDV03 PCB DESIGN USING ALTIUM DESIGNER/OrCAD/EAGLE.

Prerequisite:

Basic knowledge of: Analog devices and ICs specification with Electrical and Mechanical data, digital ICs specification with electrical and mechanical data.

Preamble:

PCB Design is one of the most elementary skills needed for an electronics engineer. This PCB Design course will give the guidelines for designing PCB starting from the fundamentals of printed circuit boards to designing single and double sided PCBs

Course Outcomes: Upon completion of the course, students will be able to design a circuit, create aschematic Capture, layout design and fabricate a PCB.

- 1. PCB Design Software (Altium Designer/OrCAD/EAGLE)
- 2. PCB Design Technology

Module 1 – Fundamentals of Platform

- PCB Design Software (Altium Designer/OrCAD/EAGLE)
- PCB Design Technology

Module 2 – Design and Implementation

- Regulator circuit using 7805
- Inverting Amplifier or Summing Amplifier using op-amp
- Full-wave Rectifier
- Astable and Monostable multivibrator using IC555

TOTAL : 30 PERIODS

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REFERENCES:

1. Mitzner.K, "Complete PCB Design Using Orcad Capture and Layout". Elsevier/ Newnes 2007.

- 1. <u>http://documentation.circuitstudio.com/display/CSTU/From+Idea+to+Manufacture+-Driving+a+PCB+Design+through+CircuitStudio</u>.
- 2. http://documentation.circuitstudio.com/display/CSTU/PCB_Cmd-Routing_Composite((Interactive+Routing))_CS

22MDV04 MODELLING SIMULATION AND ANALYSIS OF L T P C BIOLOCICAL SYSTEMS USING LabVIEW 0021

BIOLOGICAL SYSTEMS USING LabVIEW

Prerequisite:

Having basic knowledge on biological signals.

Preamble:

To familiarize with the principles of acquiring biological signals using various techniques

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Acquire biological signals using various techniques and process and analyze them
- 2. Modelling physiological parameters

Module 1 –Basics of LabVIEW and common LabVIEW functions 10

- LabVIEW terms
- Components of LabVIEW application
- LabVIEW programming tools

Module 2 – Data Acquistion of biosignals using LabVIEW

- Creating an application in LabVIEW
- Acquisition and Analysis of biological signals using LabVIEW
- Modelling of Thermal system using LabVIEW

TOTAL : 30 PERIODS

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REFERENCES:

- 1. Bruce Mihura, "LabVIEW for Everyone: Graphical Programming Made Easy and Fun" (NationalInstruments Virtual Instrumentation Series), 3rd Edition August 2006
- 2. Anshuman prakash, Dr.Lovi raj gupta, Dr. Rajesh singh, Dr Anitha Gehlot, Rydhm Beri, "Biomedicalsensors data acquisition with LabVIEW", First edition, 2020.

- 1. <u>https://youtu.be/I8pc8-VcVFo</u>," Beginners LabVIEW Tutorial 1: Getting Started with LabVIEW"
- 2. http://ece-research.unm.edu/jimp/415/labview/LV_Intro_Six_Hours.pdf

22MDV05Arduino Programming For Healthcare ApplicationsL T P C0 0 2 1

Prerequisite:

Knowledge of C, C++, Electronics, Biomedical Instrumentation, Microprocessors and Microcontrollers.

Preamble:

Arduino is an open source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board or microcontroller and a software, Integrated Development Environment (IDE) that runs on the computer. It is used to write and upload computer code to the physical board. Arduino can interact with buttons, LEDs, motors, speakers, cameras, TV and smart phones etc. It can be used for almost any electronics projects. This course develops skills of students to program, design and implement smart system applications using Arduino.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop programs on Arduino Platform for healthcare applications.
- 2. Implement a system using Arduino for healthcare applications.

Module 1 – Arduino and Arduino Programming

- Arduino and Arduino IDE
- Arduino Uno PIN specifications
- Arduino programming

Module 2 – Design and Implementation

- Introduction to Autodesk Tinkercad
- Design and simulation of circuits using Arduino in Tinkercad
- Measure and monitor heart rate using Arduino
- Saline bottle weight calculation and alert system based on Arduino
- Automatic mask and sanitizer dispenser using Arduino

TOTAL : 30 PERIODS

REFERENCES:

- 1. John Nussey, "Arduino for Dummies", Wiley, 2nd Edition, 2018.
- 2. Brain Evans, "Beginning Arduino Programming", Apress, 2011.

e-Resources:

- 1. https://www.arduino.cc/, "Arduino programming language , Arduino Software (IDE) andProcessing".
- 2. https://onlinecourses.swayam2.ac.in/aic20_sp04/, "Arduino", Prof. Kannan Moudgalya, Department of Chemical Engineering, Indian Institute of Technology Bombay.

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22MDV06Machine Learning using MATLAB/ PythonL T P C002

Prerequisite:

Knowledge on basic probability and statistics, Linear algebra and calculus. Programming skills on Matlab/Python

Preamble:

Machine learning research aims to build computer systems that learn from experience.Learning systems are not directly programmed by a person to solve a problem, but instead they develop their own program based on examples of how they should behave,or from trial-and-error experience trying to solve the problem. These systems requirelearning algorithms that specify how the system should change its behavior as a result of experience. Researchers in machine learning develop new algorithms, and try to understand which algorithms should be applied in which circumstances.

Course Outcomes: Upon completion of the course, students will be able to:

- 1 To create Machine Learning solutions using Python/MATLAB.
- 2 To evaluate and improve the performance of the created solutions.

Module 1

- Linear Regression and Logistic Regression
- Model selection
- Organizing and preprocessing data
- Clustering data
- Creating classification models
- Interpreting and evaluating models

Module 2

- Learn how to apply Convolutional Neural networks to computer vision tasks
- To detect anomalies in chest X-ray scans
- Vehicle detection to ascertain the width and strength of the road
- Gesture Recognition system

TOTAL : 30 PERIODS

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REFERENCES:

- 1. Abhishek Kumar Pandey, Pramod Singh Rathore and Dr. S. Balamurugan, "A Practical Approach for Machine Learning and Deep Learning Algorithms: Tools and Techniques Using
 - MATLAB and Python", 1St Edition, Kindle Edition.

2. Michael Paluszek and Stephanie Thomas, MATLAB Machine Learning, Apress, 2017

- 1. https://www.appliedaicourse.com/?gclid=CjwKCAjw9aiIBhA1EiwAJ_GTSopHCujFql3NxEL vSTkyhmpN7ysLgKUx6OTSEr9suE_6RiKs3WFbghoCzU0QAvD_BwE
- 2. https://youtu.be/RnFGwxJwx-0
- 3. <u>https://youtu.be/D2vZmz-JsLw</u>

22MDV07 BIOMEDICAL EQUIPMENT REPAIR AND MAINTENANCE L T P C 0 0 2 1

Prerequisite:

Knowledge of Basic Electronics, Diagnostic, Therapeutic Equipments and Radiological Equipments.

Preamble:

The Medical Equipment Technology Assistant prepares to install, calibrate, operate, maintain and troubleshoot sophisticated devices and instrumentation, which are critical for effective delivery of health care. Emphasis is placed on proper installation and operation, as well as on troubleshooting, repair, and maintenance to ensure biomedical equipment meets all applicable standards.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Perform troubleshooting and preventive maintenance of medical equipment.
- 2. Provide technical assistance and instructions on operation and maintenance of medical equipment toclinicians and technicians

Module 1 – Clinical application and Operation testing of Medical Equipment 10

- Biomedical Instrumentation and Measurement.
- Hands-on with PCB Board level testing and component level testing.
- Familiarization and working with Ultrasound machine, ECG recorders, X ray machines, ventilator, patient
- monitor, dialyzer, surgical tools etc.

Module 2 – Installation, Maintenance of Medical Equipment

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- Fundamentals of Troubleshooting.
- Installation procedure for Equipments.
- Trouble Shooting & Fault Finding Procedure of Medical Equipment.
- 4. Safety Instrumentation.

TOTAL : 30 PERIODS

REFERENCES:

- Joseph. J Carr, John M Brown, "Introduction to Biomedical Equipment Technology", JohnWiley& Sons, New York, 4thedition, 2008.
- 2. Justin Cooper, Alex Dahinten, "Medical Equipment Troubleshooting Flowchart Handbook", Engineering World Health, Version 6, 2013.

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ge14/preview, "Regulatory requirements for medical devices including in vitro diagnostics in India (Version 2.0)", Shri Aseem Sahu, Shri. Malay Mitra, CDSCO, Ministry of Health & Family Welfare, New Delhi.

2. https://bmet.ewh.org/handle/20.500.12091/434 , Fault diagnosis and repair modules ,Engineering World Health,2020.

22MDV08 DEVELOPMENT OF ASSISTIVE DEVICES FOR DISABLED PERSONS L T P C 0 0 2 1

Prerequisite:

Knowledge of C, Biomedical Instrumentation, Electronics and Embedded System.

Preamble:

People with physical disabilities are struggling every day to perform some tasks that the rest of the world find easy and require, for them, no second thoughts. Assistive devices make life easier to those people, by removing barriers and by enhancing their physical and mental capabilities. They greatly improve their quality of life, optimism and mood. This course provides a better understanding of assistive technology devices for enabling and accelerating the educational, social and economic inclusion of persons withdisabilities.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Identify and evaluate technologies that maximize the potential of people with disabilities.
- 2. Develop assist devices that addresses the needs of disabled persons.

Module 1 – Technology to build assist devices

- Disabilities and its types
- Assistive technologies
- Assistive technology hardware and software

Module 2 – Development of Assistive Devices

- Assist devices for home comfort and care
- Adaptive tools
- Eye trackers
- Speech generation and voice recognition devices
- Mobility aids and communication devices

TOTAL: 30 PERIODS

REFERENCES:

- 1. Diane Pedrotty Bryant and Brian R. Bryant, "Assistive Technology for People with Disabilities", Pearson, 2nd Edition, 2012.
- 2. Emily C. Bouck, "Assistive Technology", Sage Publications, 2017.

e-Resources:

- 1. https://onlinecourses.swayam2.ac.in/aic19_ge01/preview, "Development of Assistive technology forpersons with Disabilities" Prof. Indumathi Rao, C B R Network.
- 2. https://www.open.edu/openlearn/education-development/assistive-technologiesand-online learning/content-section-0?active-tab=content-tab

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Prerequisite:

22MDV09

Knowledge of C, C++, Python, Electronics, Biomedical Instrumentation, ZigBee, Microprocessor and Microcontrollers.

Preamble:

Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. Arduino is an open source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board or microcontroller and software. Zigbee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless IoT networks.

Course Outcomes: Upon completion of the course, students will be able to:

- 1. Develop programs for healthcare applications.
- 2. To apply and implement software skills in developing application for solving healthcare related problems in various fields of Medical sector.

Module 1 – Fundamentals of Platform

- Arduino and Arduino IDE
- Raspberry Pi
- Zigbee

Module 2 – Design and Implementation

- Introduction
- Design and simulation of circuits
- Smart healthcare monitoring system using raspberry Pi on IoT platform
- Short Range Centralized cardiac health monitoring system based on Zigbee Communication
- Body Temperature Measurement for Remote Health Monitoring System
- HealthCare System Using Raspberry Pi

TOTAL : 30 PERIODS

REFERENCES:

- 1. Brain Evans, "Beginning Arduino Programming", Apress, 2011.
- 2. Andrew Robinson, Mike Cook, "Raspberry Pi Projects", John Wiley & Sons, 2013
- 3. Robert Faludi, "Building Wireless Sensor Networks: with ZigBee, XBee, Arduino, and Processing",

O'Reilly Media, 2010

e-Resources:

- 1. https://nptel.ac.in/courses/106/105/106105166/, " Introduction to Raspberry", Prof. Sudip Misra ,Indian Institute of Technology, Kharagpur
- 2. https://www.arduino.cc/, "Arduino programming language, Arduino Software (IDE) and Processing".
- 3. https://www.youtube.com/watch?v=UvQFH5RGOnU, "The AmbuSens system for IoT-based healthcare monitoring",Indian Institute of Technology.

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22MDV10Designing of Medical Devices using Autodesk Fusion 360.L T P C0 0 2 1

Prerequisite:

Ideate, design, prototype, and make medical and health products by Autodesk fusion 360 Software

Preamble:

Fusion 360 is a cloud-based CAD/CAM tool for collaborative product development.Fusion 360 enables exploration and iteration on product ideas and collaboration within distributed product development team.Fusion 360 combines organic shapes modelling, mechanical design and manufacturing in one comprehensive package.In this course students will get the basic knowledge about medical product design in Autodesk Fusion 360.

Course Outcomes: Upon completion of the course, students will be able to:

1. to design medical devices that comply with all federal standards using Fusion 360

Module 1 – Fundamentals of Autodesk Fusion 360

- Introduction to Autodesk Fusion 360
- Workspace and Navigation
- Creating sketched Geometry
- Additional sketching tools

Module 2 – Create Organic Shapes and Hybrid Modeling

- Loft features
- Distributed design
- Multi body design
- Creating the lofted surface body using standard tools
- Creating geometry to connect the bodies

TOTAL : 30 PERIODS

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REFERENCES:

- 1. CameronCoward," A Beginner's Guide to 3D Modeling: A Guide to Autodesk Fusion 360", No starch press, 2019.
- 2. Sachidanand Jha,"AUTODESK FUSION 360 EXERCISES: 200 Practice Drawings For FUSION 360and Other Feature-Based Modeling Software", 2019

- 1. <u>https://youtu.be/O9uu6hSWXjE</u>
- 2. <u>https://youtu.be/c7OlPj2K3Po</u>