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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.

Covering letter to Dean Academics for submission of BOS minutes

To
The Dean -Academics
K L Deemed University
Vaddeswaram

Dear Sir,

Sub: Minutes of the 22nd BOS meeting in Department held on 27 March 2023 conducted on blended mode from 3.00 PM to 5.00 PM- reg.,

Offline venue: R403.
Online link:
https://kluniversity.webex.com/kluniversity/j.php?MTID=mae96a20defb9939f8ff8e4762ff16d5e
Saturday, March 25, 2023 3:00 PM | 3 hours | (UTC+05:30) Chennai, Kolkata, Mumbai, New Delhi
Meeting number: 2641 588 8961
Password: VMpXFkbZ468

The agenda items and respective resolutions are appended for further proceedings.

Recorded Link:
https://kluniversity.webex.com/recordingservice/sites/kluniversity/recording/playback/5e840414ad1f103b9fffb6eb4d23779d

Thanking You,

Yours sincerely

Dr. Suman Maloji
Chairman BOS, ECE

Dr. M. SUMAN
Professor & Head
Department of ECE
K L E F
Green Fields, Vaddeswaran
Guntur Dist., A.P. PIN: 522 502

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AGENDA and RESOLUTIONS

AGENDA ITEM-1

To approve the course structures of Y23 admitted batch (B.Tech & M.Tech)	**Resolution Approved and Forwarded to Academic Council**

Sl.No.	Program Name	Discipline
1	B. Tech.	ECE

Sl.No.	Program Name	Specialization
1	M. Tech.,	Robotics &Automation
2		RADAR & Communication
3		VLSI

1. It is resolved to approve the proposed course structures of the B.Tech (ECE) Y23 admitted batch.
   - List of Honors through Research, Experience Learning and Research new courses are included
2. It is resolved to approve the modified course structures of Y23 M. Tech programs.
   - M. Tech RADAR & Communication
   - M. Tech VLSI (Analog IC Design is recommended to be in the 1st Sem and Low Power VLSI System Design in 2nd Semester)
   - M. Tech Robotics &Automation
   - The course "Artificial Intelligence & Machine Learning' must have the last 2 COs with Specialization Specific.

[Annexure-I]

AGENDA ITEM-2

To approve the course structures of Y23 admitted batch M. Tech EMBEDDED SYSTEMS	**Resolution Approved**

- All the BoS members approved the formulation of M. Tech Embedded systems and it is forwarded to Dean Academics for further approval.

[Annexure-II]

AGENDA ITEM-3

To approve the list of new courses and syllabus revision for Y23 admitted batch (B.Tech & M.Tech)	**Resolution Approved and Forwarded to Academic Council**

- It is resolved to approve the new courses and syllabus revised courses in B. Tech ECE and M. Tech (VLSI, RA, and RC) programs.

[Annexure-III]

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AGENDA ITEM-3

To approve the academic flexibility offered to B. Tech ECE students admitted in Y23	**Resolution Approved**

- All the BoS members approved the academic flexibility offered and forwarded to Dean Academics for further approval.

[Annexure-IV]

AGENDA ITEM-4

To approve the modification and up gradation of courses under Y22 structure (B.Tech)	**Resolution Approved**

- All the BoS members approved to follow the modified course structure for AY 22 admitted batch and it is forwarded to Dean Academics for further approval.

[Annexure-V]

AGENDA ITEM-5

To approve the modification and up gradation of courses under Y21 structure (B.Tech)	**Resolution Passed**

- All the BoS members approved to follow the modified course structure for AY 21 admitted batch and it is forwarded to Dean Academics for further approval.

[Annexure-VI]

AGENDA ITEM-6

To approve the modification and up gradation of courses under Y20 structure (B.Tech)	**Resolution Passed**

- All the BoS members approved to follow the modified course structure for AY 21 admitted batch and it is forwarded to Dean Academics for further approval.

[Annexure-VII]

AGENDA ITEM-7

To approve the courses for pre-PhD examination.	**Resolution Passed**

- All the committee members have accepted the courses for pre-PhD examination.

[Annexure-VIII]

AGENDA ITEM-8

To approve the list of value-added courses for odd semester 2023-2024.	**Resolution Passed**

- The BoS members approved the list of value-added courses offered in the Odd semester AY 2023-24.

[Annexure-IX]

AGENDA ITEM-9

Any special cases for consideration	**Resolution Passed**

NIL

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Members of BOS:

Sl.No.	Faculty Name	Designation	Role
1	Dr.M.Suman	HOD	Chairperson
2	Dr. Anil Vuppala	Asst. Prof., IIIT Hyderabad	Academic Peer
3	Dr. Senthil Sivakumar	Asst. Prof., IIIT Tiruchirappalli	Academic Peer
4	Mr. Sravan Kumar K	Siemens EDA, Bengaluru	Alumni
5	Mr. Srinivas Vedala	Apple Inc., Bengaluru	Industry Expert
6	Dr.M.Venkata Narayana	Deputy HOD	Member
7	Dr.I.Govardhani	Professor	Member
8	Dr.K.Ch.Sri Kavya	Director, Alumni	Member
9	Dr.K.S.Ramesh	Professor	Member
10	Dr.B.T.P.Madhav	Director-Academic Research	Member
11	Dr.K.Sarat Kumar	Director R&D, and Training	Member
12	Dr.K.Hari Kishore	Assoc.Dean-Sports	Member
13	Dr.D.Venkata Ratnam	Research HOD	Member
14	Dr.G.V.Subbarao	Professor	Member
15	Dr.K.Kumar Naik	Professor	Member
16	Dr.A.S.C.S.Sastry	Controller of Examination	Member
17	Dr. Md.Z Rahman	RPAC Chair Person	Member
18	Dr.P.Venkat Vijay Kishore	Professor	Member
19	Dr.P.Pardhasaradhi	Assoc.Dean-Publications	Member
20	Dr.S.Koteswararao	Professor	Member
21	Dr.K.Srinivasarao	Professor	Member
22	Dr.V.S.V.Prabhakar	DirectorIndustry Connect	Member
23	Dr.P. Satya Srinivas Babu	Professor	Member
24	Dr. T. Rama Krishna	Professor	Member
25	Dr.M.Ravi Kumar	Associate Professor	Member
26	Dr. N.V.K.Ramesh	Assoc.Dean-Academics	Member
27	Dr.K.Ravi kumar	Addl.Controllerof Examination	Member
28	Dr.G.Venkata Ganesh	Associate Professor	Member
29	Dr.M.Siva Kumar	Associate Professor	Member
30	Dr.Syed Inthiyaz	Assoc.Dean -P&D	Member
31	Dr.Fazal Noorbasha	Assoc.Dean-Academics	Member
32	Dr.G.R.K.Prasad	Assoc.Dean-P&D	Member
33	Dr.D.Bhavana	Associate Professor	Member
34	Dr.C.Sreevardhan	Addl.Controllerof Examination	Member
35	Dr.Ch.Raghava Prasad	Addl.Controllerof Examination	Member
36	Dr.China Satyanarayana	Associate Professor	Member
37	Dr.Sampad Kumar Panda	Associate Professor	Member
38	Dr.R.S.Ernest Ravindran	Associate Professor	Member
39	Dr.Y.Usha Devi	Associate Professor	Member

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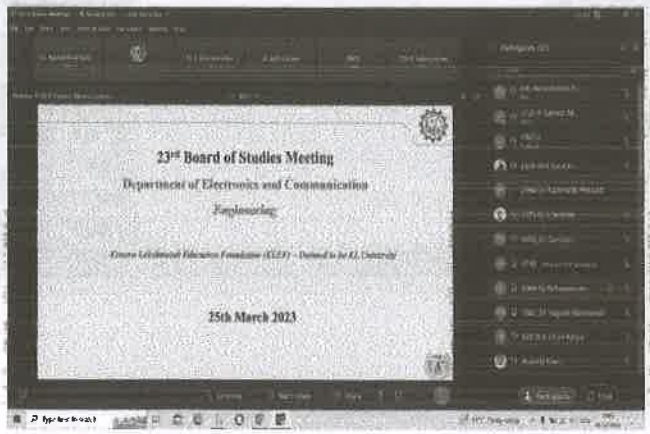
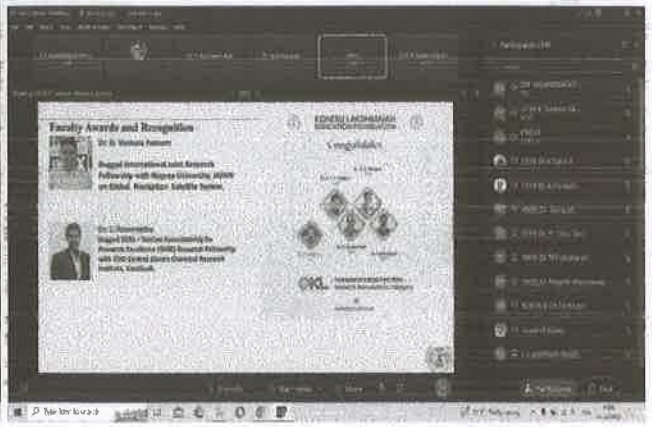
40	Dr.P.Lakshman	Deputy HOD	Member
41	Dr.M.Kasi Prasad	Associate Professor	Member
42	Dr.N.Prabakaran	Associate Professor	Member
43	Dr.Vipul Agarwal	Associate Professor	Member
44	Dr.C.S. Preetham Reddy	Associate Professor	Member
45	Dr.Bukya Balaji	Associate Professor	Member
46	Dr.SV.Aswin Kumer	Associate Professor	Member
47	Dr.R.Revathi	Associate Professor	Member
48	Dr.S.Rooban	Associate Professor	Member
49	Dr.Chella Santhosh	Associate Professor	Member
50	Dr.S.Arunmetha	Associate Professor	Member
51	Dr.Arjuna muduli	Associate Professor	Member
52	Dr.E.Kiran Kumar	Associate Professor	Member
53	Dr.Aravind Kilaru	Dy.Director, colabrations	Member
54	Dr.N Phalguni Singh	Associate Professor	Academic Prof. I/C
55	Dr. Saleem Akram	Associate Professor	Academic Prof. I/C
56	Dr.Aravindhan A	Assoc.Dean, Acadamics	Member
57	Dr.Ashish Kumar	Associate Professor	Member
58	Dr. Sumit Bhushan	Associate Professor	Member
59	Dr. Vivekananthan V	Associate Professor	Member
60	Dr.M.Vasuja Devi	Assoc.Dean-Greavens	Member

***40 Members attended Online and 20 Members attended the meeting Offline.**

Few pics/Screenshots of BOS meeting





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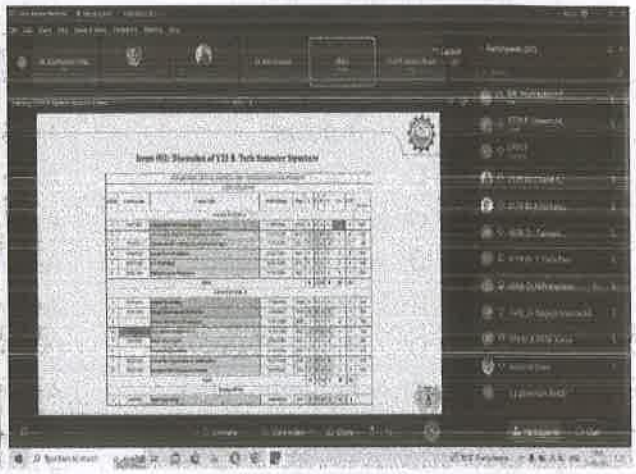

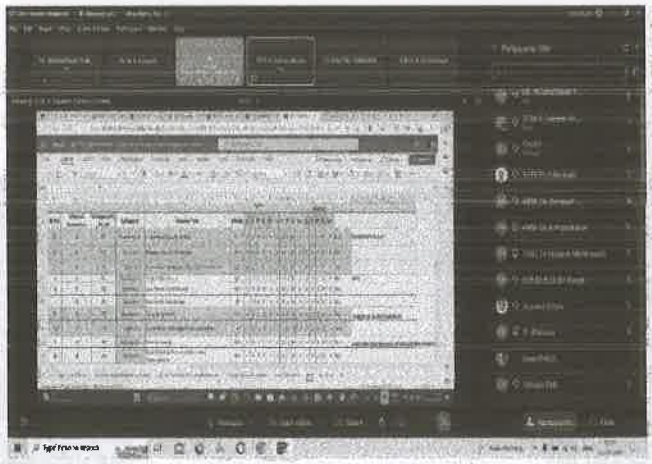

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Annexure II

B.TECH ECE Y23 COURSE STRUCTURE

Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake holder feedback	Justification
1	AUC	23UC0008	INDIAN CONSTITUTION	R	2	0	0	0	0	0	NIL			No		Basic course helps better employment
2	AUC	22UC0009	ECOLOGY & ENVIRONMENT	R	2	0	0	0	0	0	NIL			No		Basic course helps better employment
3	AUC	23UC0013	GLOBAL LOGIC BUILDING CONTEST PRACTICUM	R	0	0	0	2	0	0	NIL	EMPLOYMENT	Problem Solving	**YES**	Faculty	Basic course helps better employment
4	AUC	23UC0014	GLOBAL LOGIC BUILDING CONTEST PRACTICUM	R	0	0	0	2	0	0	NIL	EMPLOYMENT	Problem Solving	**YES**	Faculty	Basic course helps better employment
5	AUC	23UC0017	INDIAN ANCIENT KNOWLEDGE SYSTEMS: VEDIC MATHEMATICS	R	2	0	0	0	0	2	NIL			No		Basic course helps better employment
			Total		**6**	**0**	**0**	**4**	**0**	**2**						
6	HAS	23UC1102	LANGUAGE SKILLS FOR ENGINEERS	R	0	0	4	0	2	4	NIL			No		Course helps towards entrepreneurs hip
7	HAS	23UC0026	HUMAN VALUES, GENDER EQUALITY & PROFESSIONAL ETHICS	R	2	0	0	0	2	0	NIL			No		Course helps towards entrepreneurs hip

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Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake holder feedback	Justification
8	HAS	23UC1204	COMMUNICATION SKILLS FOR ENGINEERS	R	0	0	4	0	2	4	NIL			No		Course helps towards entrepreneurs hip
9	HAS	23FLXXXX	FOREIGN LANGUAGE ELECTIVE	R	3	0	0	0	3	0	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No		Basic course helps better employment
10	HAS	23UC0027	LEADERSHIP AND MANAGEMENT SKILLS	R	0	0	4	0	2	4	NIL	ENTREPRENEURS HIP	Case Studies based learning	**Yes**		Course helps towards entrepreneurs hip
11	HAS	23MB4068	INNOVATION MANAGEMENT	R	4	0	0	0	4	4	NIL	ENTREPRENEURS HIP	Case Studies based learning	**Yes**		Course helps towards entrepreneurs hip
			TOTAL		**9**	**0**	**12**	**0**	**15**	**16**						
12	SIL	22UC0021	SOCIAL IMMERSIVE LEARNING	R	0	0	0	4	1	4	NIL			No		Basic course helps better employment
13	SIL	22UC0022	SOCIAL IMMERSIVE LEARNING	R	0	0	0	4	1	0	NIL			No		Basic course helps better employment
14	SIL	22UC0023	SOCIAL IMMERSIVE LEARNING	R	0	0	0	4	1	0	NIL			No		Basic course helps better employment
			Total		**0**	**0**	**0**	**12**	**3**	**4**						
15	BSC	23MT1001	LINEAR ALGEBRA & CALCULUS FOR ENGINEERS	R	2	2	0	0	4	4	NIL			YES	FACULTY	Basic course helps better employment

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16	BSC	23MT1002	DISCRETE MATHEMATICS	R	2	0	2	4	4	4	NIL			**YES**	FACULTY	Basic course helps better employment
17	BSC	23MT2007	RANDOM VARIABLES AND STOCHASTIC PROCESS	R	2	2	0	0	4	4	NIL			**YES**	FACULTY	Basic course helps better employment
18	BSC	22MT2006	OPTIMIZATION IN ENGINEERING	R	2	2	0	0	4	4	NIL			**YES**	FACULTY	course helps better employment
19	BSC	23PH1005	ENGINEERING PHYSICS	R	3	0	2	0	4	3	NIL			No		course helps better employment
20	BSC	23CY1001	ENGINEERING CHEMISTRY	R	3	0	2	0	4	3	NIL			No		course helps better employment
			Total		**14**	**6**	**6**	**4**	**24**	**22**						
21	ESC	23EC1101	FUNDAMENTALS OF IOT & SENSORS	R	2	0	4	0	4	6	NIL			**YES**	Faculty	Basic course to engineers must know.
22	ESC	23SC1101	COMPUTATIONAL THINKING FOR STRUCTURED DESIGN	R	3	0	2	4	5	9	CTSD			No		Basic course helps better employment
23	ESC	23UC1203	DESIGN THINKING FOR INNOVATION	R	2	0	2	0	3	4	NIL	ENTREPRENEURSHIP	Case Studies based learning	No		Basic course helps better employment
24	ESC	23EC1203	BASIC ELECTRICAL AND ELECTRONIC CIRCUITS	R	2	0	0	0	2	2	NIL			**Revised**		Basic course to engineers must know.

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25	ESC	23EC1202	DIGITAL DESIGN & COMPUTER ARCHITECTURE	R	3	0	2	0	4	5	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	YES		Basic course to engineers must know.
26	ESC	23SC1203	DATA STRUCTURES	R	3	0	2	4	5	9	NIL			No		Basic course helps better employment
27	ESC	23ME1103	DESIGN TOOLS WORKSHOP	R	0	0	4	0	2	4	CTSD	ENTREPRENEURSHIP	Case Studies based learning	No		Basic course helps for Enterprenship
28	ESC	23SC2006	OBJECT ORIENTED PROGRAMMING	R	3	0	2	0	4	5	CTSD	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Basic course helps better employment
			Total		**18**	**0**	**18**	**8**	**29**	**44**						
29	PCC	23EC2210	NETWORK PROTOCOLS & SECURITY	R	3	0	2	0	4	5	DDCA	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
30	PCC	23EC2106	PROCESSORS & CONTROLLERS	R	3	0	2	0	4	5	DDCA	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
31	PCC	23EC2104	ANALOG ELECTRONIC CIRCUIT DESIGN	R	3	0	2	2	4.5	7	BEEC	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment

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Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake Holder feedback	Justification
32	PCC	23EC2105	SIGNALS & COMMUNICATION SYSTEMS	R	3	0	2	0	4	5	LACE	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
33	PCC	23EC2209	ELECTROMAGNETIC WAVES & TRANSMISSION LINES	R	3	0	0	0	3	3	LACE	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
34	PCC	23EC2208	DIGITAL COMMUNICATION	R	3	0	2	0	4	5	SCS	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
35	PCC	23EC2211	VLSI DESIGN	R	3	0	2	2	4.5	7	AECD	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
36	PCC	23EC3112	DISCRETE TIME SIGNAL PROCESSING	R	3	0	2	0	4	5	DC	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
37	PCC	23AD2001O	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	R	3	0	2	0	4	5		EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Core course helps better employment
					27	**0**	**16**	**4**	**36**	**47**						

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Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake holder feedback	Justification
38	PEC		FLEXI-CORE -I	R	2	0	2	0	3	4	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Core course helps better employment
39	PEC		FLEXI-CORE -II	R	2	0	2	0	3	4	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Core course helps better employment
40	PEC		PROFESSIONAL ELECTIVE - 1	R	3	0	2	4	5	9	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Professional elective course helps better employment
41	PEC		PROFESSIONAL ELECTIVE - 2	R	3	0	0	0	3	3	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Professional elective course helps better employment
42	PEC		PROFESSIONAL ELECTIVE - 3	R	3	0	2	4	5	9	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Professional elective course helps better employment
43	PEC		PROFESSIONAL ELECTIVE - 4	R	3	0	0	0	3	3	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Professional elective course helps better employment
44	PEC		PROFESSIONAL ELECTIVE - 5 (SPECIALIZATION)	R	3	0	0	0	3	3	RELEVENT COURSE	EMPLOYABILITY	Practice based learning	No		Professional elective course helps better employment

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Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake holder feedback	Justification
			Total		16	0	8	8	22	32						
45	SDC	23SDEC01	ELECTRONIC SYSTEM DESIGN	R	0	0	2	4	2	6		ENTREPRENEURSHIP	Case Studies based learning	No		Basic course helps for Enterprenship
46	SDC	23SDEC01	EMBEDDED SYSTEM AUTOMATION	R	0	0	2	4	2	6		ENTREPRENEURSHIP	Case Studies based learning	No		Basic course helps for Enterprenship
47	SDC		SKILL DEVELOPMENT PROJECT - 3 (SPECIALIZATION BASED SKILL)	R	0	0	2	4	2	6		ENTREPRENEURSHIP/SKILL DEVELOPMENT	Case Studies based learning	No		Basic course helps for Enterprenship
48	SDC		SKILL DEVELOPMENT PROJECT - 4 (ONLY FOR SPECIALIZATION/ HONORS)		0	0	2	4	2	6		ENTREPRENEURSHIP/SKILL DEVELOPMENT	Case Studies based learning	No		Basic course helps for Enterprenship
			Total		**0**	**0**	**6**	**16**	**6**	**18**						
49	PRI	23IE2040	SOCIAL INTERNSHIP	R	0	0	0	4	0	0	RELEVENT COURSE	EMPLOYABILITY	Practice based learning, Problem Solving			Project based course helps better employment and Entrepreneurship
50	PRI	23IE3041	TECHNICAL INTERNSHIP	R	0	0	0	4	0	0	RELEVENT COURSE	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment and Entrepreneurship

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Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake holder feedback	Justification
51	PRI	23IE4053	ENGINEERING CAPSTONE PROJECT - 1	R	0	0	8	16	8	12	RELEVENT COURSE	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment and Entrepreneurship
52	PRI	232IE4054	ENGINEERING CAPSTONE PROJECT - 2	R	0	0	8	16	8	12	RELEVENT COURSE	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment and Entrepreneurship
53	PRI	23IE4051	INDUSTRIAL INTERNSHIP	ALT	0	0	8	16		24	RELEVENT COURSE	EMPLOYABILITY / SKILL DEVELOPMENT/ENTREPRENEURSHIP	Practice based learning, Problem Solving, Case Studies based learning			Project based course helps better employment and Entrepreneurship
			Total		**0**	**0**	**24**	**56**	**16**	**24**						
54	OEC		OPEN ELECTIVE - 1	R/M	4	0	0	0	4	0	RELEVENT COURSE	EMPLOYABILITY / ENTREPRENEURSHIP	Practice based learning, Problem Solving			Open elective course helps better employment
55	OEC		OPEN ELECTIVE - 2	R/M	4	0	0	0	4	0	RELEVENT COURSE	EMPLOYABILITY / ENTREPRENEURSHIP	Practice based learning, Problem Solving			Open elective course helps better employment

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56	OEC		OPEN ELECTIVE - 3	R/M	4	0	0	0	4	0	RELEVENT COURSE	EMPLOYABILITY / ENTREPRENEURSHIP	Practice based learning, Problem Solving			Open elective course helps better employment
57	OEC		MANAGEMENT ELECTIVE	R/M	4	0	0	0	4	0	NIL	EMPLOYABILITY / ENTREPRENEURSHIP	Practice based learning, Problem Solving			elective course helps better employment
			Total		**16**	**0**	**0**	**0**	**16**	**0**						
58	VAC		VALUE ADDED COURSE-1	R/M	0	0	0	8	0	0	N/A	EMPLOYABILITY / SKILL DEVELOPMENT/ENTREPRENEURSHIP	Practice based learning, Problem Solving, Case Studies based learning			course helps better employment
59	VAC		VALUE ADDED COURSE-2	R/M	0	0	0	8	0	0	N/A	EMPLOYABILITY / SKILL DEVELOPMENT/ENTREPRENEURSHIP	Practice based learning, Problem Solving, Case Studies based learning			course helps better employment

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Sl No	Category	Course Code	Course Title	Mode	L	T	P	S	Cr	CH	Pre-Requisite	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category (Yes/No)	New Course	Stake holder feedback	Justification
60	VAC		VALUE ADDED COURSE-3	R/M	0	0	0	8	0	0	N/A	EMPLOYABILITY / SKILL DEVELOPMENT/ENTREPRENEURSHIP	Practice based learning, Problem Solving, Case Studies based learning			course helps better employment
61	VAC		SPORTS/YOGA CERTIFICATION	R/M	0	0	0	2	0	2	N/A					
			Total		**0**	**0**	**0**	**26**	**0**	**2**						
			Grand Total		**102**	**6**	**90**	**138**	**166**	**195**						

No of new courses: 11

Total no of courses: 61

Percentage New courses: (11/61)*100 = 18.03%

Percentage of Courses Revised = (01/61) * 100 = 1.63%

Percentage of Program Syllabus Revision = (12/61) = 19.67%

Percentage of Courses focusing on Employability = (33/61) * 100 = 54.09 %

Percentage of Courses focusing on Entrepreneurship = (15/61) * 100 = 32 %

Percentage of Courses focusing on Skill Development = (20/61) * 100 = 63 %

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Specialization-wise list of Courses (For both Y24 &Y23 Batch students):

BIO-MEDICAL INSTRUMENTATION

S no	Course Category	Course Title	Mode	L	T	P	S	Cr	CH
1	FC1	BIOMEDICAL ELECTRONICS & IOT FOR HEALTHCARE	Regular/ Advanced	2	0	2	0	3	4
2	FC2	ELECTRONIC CIRCUITS FOR MEDICAL INSTRUMENTATION	Regular/Advanced	2	0	2	0	3	4
3	PEC-1	BIOMEDICAL SIGNAL AND IMAGE PROCESSING	Regular/Advanced	3	0	2	4	5	9
4	PEC-2	ADVANCED BIOMEDICAL SIGNAL PROCESSING	Regular/Advanced	3	0	0	0	3	3
5	PEC-3	MATERIALS FOR BIO-MEDICAL APPLICATIONS	Regular/Advanced	3	0	2	4	5	9
6	PEC-4	NANOTECHNOLOGY AND NANOSENSORS	Regular/Advanced	3	0	0	0	3	3
7	PEC-5	BIOSENSING AND BIOELECTRONICS	Advanced	2	0	2	0	3	4

COMPUTER COMMUNICATION & 5G TECHNOLOGIES

S no	Course Category	Course Title	Mode	L	T	P	S	Cr	CH
1	PCC	NETWORK PROTOCOLS & SECURITY	Regular/Advanced	3	0	2	0	4	5
2	FC1	**RESILIENT NETWORK ENGINEERING**	Regular/Advanced	2	0	2	0	3	4
3	FC2	WIRELESS LAN	Regular/Advanced	2	0	2	0	3	4
4	PEC-1	TCP/IP & OTHER PROTOCOL SUITE	Regular/Advanced	3	0	2	4	5	9
5	PEC-2	CLOUD COMPUTING AND NETWORKS SECURITY	Regular/Advanced	3	0	0	0	3	3
6	PEC-3	VOIP AND BROADBAND NETWORKS	Regular/Advanced	3	0	2	4	5	9
7	PEC-4	5G MOBILE AND IEEE STANDARDS	Regular/Advanced	3	0	0	0	3	3
8	PEC-5	IP MULTIMEDIA SUB-SYSTEM & EMERGING TECHNOLOGIES	Advanced	2	0	2	0	3	4

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DATA COMMUNICATIONS									
S no	**Course Category**	**Course Title**	**Mode**	**L**	**T**	**P**	**S**	**Cr**	**CH**
19	**PCC**	SIGNALS & COMMUNICATION SYSTEMS	Regular/Advanced	3	0	2	0	4	5
20	**PCC**	DIGITAL COMMUNICATION	Regular/Advanced	3	0	2	0	4	5
21	**FC1**	WIRELESS COMMUNICATIONS	Regular/Advanced	2	0	2	0	3	4
22	**FC2**	RADIO WAVE PROPAGATION	Regular/Advanced	2	0	2	0	3	4
23	PEC-1	4G WIRELESS TECHNOLOGIES AND CELLULAR COMMUNICATION	Regular/Advanced	3	0	2	4	5	9
24	PEC-2	MODERN SATELLITE COMMUNICATION SYSTEMS	Regular/Advanced	3	0	0	0	3	3
25	PEC-3	5G WIRELESS TECHNOLOGIES	Regular/Advanced	3	0	2	4	5	9
26	PEC-4	OPTICAL WIRELESS COMMUNICATIONS	Regular/Advanced	3	0	0	0	3	3
27	PEC-5	MACHINE LEARNING FOR WIRELESS COMMUNICATION	Advanced	2	0	2	0	3	4
EMBEDDED SYSTEMS & IoT									
S no	**Course Category**	**Course Title**	**Mode**	**L**	**T**	**P**	**S**	**Cr**	**CH**
28	**ESC**	FUNDAMENTALS OF IOT & SENSORS	Regular/Advanced	3	0	4	0	5	7
29	**PCC**	PROCESSORS & CONTROLLERS	Regular/Advanced	3	0	2	0	4	5
30	**FC1**	EMBEDDED SYSTEM DESIGN	Regular/Advanced	2	0	2	0	3	4
31	**FC2**	WIRELESS SENSOR NETWORKS	Regular/Advanced	2	0	2	0	3	4
32	PEC-1	ADVANCED EMBEDDED SYSTEMS	Regular/Advanced	3	0	2	4	5	9
33	PEC-2	EMBEDDED SYSTEMS FOR IOT	Regular/Advanced	3	0	0	0	3	3
34	PEC-3	EMBEDDED AND REAL-TIME SYSTEMS	Regular/Advanced	3	0	2	4	5	9
35	PEC-4	CLOUD AND EDGE COMPUTING	Regular/Advanced	3	0	0	0	3	3
36	PEC-5	EDGE COMPUTING & DATA ANALYTICS IN IOT	Advanced	2	0	2	0	3	4

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INTELLIGENT MULTIMEDIA PROCESSING (ARTIFICIAL GENERAL AND GENERATIVE INTELLIGENCE)

S no	Course Category	Course Title	Mode	L	T	P	S	Cr	CH
37	**BSC**	RANDOM VARIABLES AND STOCHASTIC PROCESS	Regular/Advanced	2	2	0	0	4	4
38	**BSC**	OPTIMIZATION IN ENGINEERING	Regular/Advanced	2	2	0	0	4	4
39	**FC1**	DEEP NETWORK ARCHITECTURES	Regular/Advanced	2	0	2	0	3	4
40	**FC2**	DEEP LEARNING FOR COMPUTER VISION APPLICATIONS	Regular/Advanced	2	0	2	0	3	4
41	PEC-1	NATURAL LANGUAGE PROCESSING & APPLICATIONS	Regular/Advanced	3	0	2	4	5	9
42	PEC-2	ARTIFICIAL LEARNING SYSTEMS	Regular/Advanced	3	0	0	0	3	3
43	PEC-3	GENERATE AI ARCHITECTURES	Regular/Advanced	3	0	2	4	5	9
44	PEC-4	QUANTUM COMPUTING	Regular/Advanced	3	0	0	0	3	3
45	PEC-5	DATA ENGINEERING	Advanced	2	0	2	0	3	4
46	PEC-5	DATA VISUALISATION	Advanced	2	0	2	0	3	4
46	PEC-5	BIO-MEDICAL SIGNAL AND IMAGE ANALYSIS	Advanced	2	0	2	0	3	4

RF & MICROWAVE

S no	Course Category	Course Title	Mode	L	T	P	S	Cr	CH
47	**PCC**	ELECTROMAGNETIC WAVES & TRANSMISSION LINES	Regular/Advanced	3	0	0	0	3	3
48	**FC1**	RADIATING SYSTEMS & WAVE PROPAGATION	Regular/Advanced	2	0	2	0	3	4
49	**FC2**	RF SYSTEM DESIGN	Regular/Advanced	2	0	2	0	3	4
50	PEC-1	MICROWAVE ENGINEERING	Regular/Advanced	3	0	2	4	5	9
51	PEC-2	ADVANCED ANTENNA DESIGN FOR WIRELESS AND 5G APPLICATIONS	Regular/Advanced	3	0	0	0	3	3
52	PEC-3	MODERN RADAR SYSTEMS & NAVIGATIONAL AIDS	Regular/Advanced	3	0	2	4	5	9
53	PEC-4	RF AND MILLIMETER-WAVE CIRCUIT DESIGN	Regular/Advanced	3	0	0	0	3	3
54	PEC-5	SATELLITE DESIGN	Advanced	2	0	2	0	3	4

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ROBOTICS & AUTOMATION									
S no	**Course Category**	**Course Title**	**Mode**	**L**	**T**	**P**	**S**	**Cr**	**CH**
55	FC1	FUNDAMENTALS OF ROBOTICS	Regular/Advanced	2	0	2	0	3	4
56	FC2	ELECTRONICS INSTRUMENTS & AUTOMATION	Regular/Advanced	2	0	2	0	3	4
57	PEC-1	ROBOT MOTION PLANNING, DYNAMICS AND CONTROL	Regular/Advanced	3	0	2	4	5	9
58	PEC-1	ADVANCED ROBOTICS	Regular/Advanced	3	0	2	4	5	9
59	PEC-2	AUTONOMOUS VEHICLES & AUTOMOTIVE ELECTRONICS	Regular/Advanced	3	0	0	0	3	3
60	PEC-2	ROBOT MANIPULATION AND WHEELED MOBILE ROBOTS	Regular/Advanced	3	0	0	0	3	3
61	PEC-3	AUTONOMOUS MOBILE ROBOT SYSTEMS	Regular/Advanced	3	0	2	4	5	9
62	PEC-4	ARTIFICIAL INTELLIGENCE FOR ROBOTICS	Regular/Advanced	3	0	0	0	3	3
63	PEC-4	HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE	Regular/Advanced	3	0	0	0	3	3
64	PEC-5	COMPUTER VISION FOR ROBOTICS APPLICATIONS	Advanced	2	0	2	0	3	4
VLSI									
S no	**Course Category**	**Course Title**	Mode	L	T	P	S	Cr	CH
67	ESC	DIGITAL DESIGN & COMPUTER ARCHITECTURE	Regular/Advanced	3	0	2	0	4	5
68	ESC	BASIC ELECTRICAL & ELECTRONIC CIRCUITS	Regular/Advanced	2	0	0	0	2	2
66	PCC	ANALOG ELECTRONIC CIRCUIT DESIGN	Regular/Advanced	3	0	2	0	4	5
65	PCC	VLSI DESIGN	Regular/Advanced	3	0	2	2	4.5	7
69	FC1	DIGITAL VLSI DESIGN	Regular/Advanced	2	0	2	0	3	4
70	FC2	RTL DESIGN AND VERIFICATION	Regular/Advanced	2	0	2	0	3	4
72	PEC-1	ASIC AND FPGA DESIGN	Regular/Advanced	3	0	2	4	5	9
73	PEC-2	LOW POWER VLSI CIRCUITS	Regular/Advanced	3	0	0	0	3	3
74	PEC-3	ANALOG VLSI DESIGN	Regular/Advanced	3	0	2	4	5	9
75	PEC-4	TESTING AND VERIFICATION OF VLSI CIRCUITS	Regular/Advanced	3	0	0	0	3	3
76	PEC-5	MIXED-SIGNAL IC DESIGN	Advanced	2	0	2	0	3	4

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List of Honors through Research, Experience Learning and Research new courses

S.No	CATEGORY	SUB_CATEGORY	COHORT	REF CODE	COURSECODE	COURSE_TITLE	MODE	L	T	P	S	I	N	CR	C
1	HFC	HFC-CORE	E04	23EC02HF	23EC02HF	SENSORS AND TRANSDUCERS	R	3	0	2	0	0	0	4	
2	HFC	HFC-CORE	E07	23EC03HF	23EC03HF	PEER TO PEER NETWORKS	R	3	0	2	0	0	0	4	
3	HFC	HFC-CORE	E21	23EC04HF	23EC04HF	SMART SMALL SATELLITES: DESIGN, MODELLING AND DEVELOPMENT	R	3	0	2	0	0	0	4	
4	HFC	HFC-CORE	E29	23EC01HF	23EC01HF	VLSI PHYSICAL DESIGN AUTOMATION	R	3	0	2	0	0	0	4	
9	HRC	HRC-CORE	E13	23EC04RF	23EC04RF	BIO-MEDICAL SIGNAL AND IMAGE ANALYSIS	R	2	0	2	0	0	0	3	
10	HRC	HRC-CORE	E21	23EC01RF	23EC01RF	MODERN ANTENNA TECHNOLOGIES AND PROPAGATION	R	2	0	2	0	0	0	3	
11	HRC	HRC-CORE	E22	23EC02RF	23EC02RF	SWARM ROBOTICS CONTROL SYSTEMS	R	2	0	2	0	0	0	3	
12	HRC	HRC-CORE	E29	23EC03RF	23EC03RF	SYSTEM-ON-CHIP	R	2	0	2	0	0	0	3	
13	HEC	HEC-CORE	E04	23EC01EF	23EC01EF	VLSI CIRCUITS FOR BIOMEDICAL APPLICATIONS	E	0	0	6	4	0	0	4	1
14	HEC	HEC-CORE	E12	23EC03EF	23EC03EF	AUTOMOTIVE EMBEDDED SYSTEM DESIGN	E	0	0	6	4	0	0	4	1
15	HEC	HEC-CORE	E13	23EC04EF	23EC04EF	DATA VISUALIZATION	E	0	0	6	4	0	0	4	1
16	HEC	HEC-CORE	E29	23EC02EF	23EC02EF	ADVANCED DIGITAL IC DESIGN	E	0	0	6	4	0	0	4	1

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M. Tech Y23 course structure for AY 2023-24 admitted batch.

DEPARTMENT OF ECE M.TECH – VLSI – Y23 STRUCTURE															
S.No	**Course Code**	**Course Name**	**Mode**	**Course Cat**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development**	**Course Category**	**New Course (Yes/ No)**	**Stakeholder Feedback**	**Justification**
AUDIT COURSES (CREDITS=00)															
1	23UC5201	PROFESSIONAL COMMUNICATION SKILS	R	AUC	0	0	4	0	0	4			No		
2	23VL5202	ALGORITHMS FOR VLSI UTOMATION	R	AUC	0	0	4	0	0	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
ENGINEERING SCIENCE COURSES (CREDITS=04)															
3	23VL5001	TRANSFORMATION TECHNIQUES, RANDOM VARIABLES & STOCHASTIC PROCESSES	R	ESC	2	2	0	0	4	4			**Yes**	**Academic Peer**	
PROFESSIONAL CORE COURSES (CREDITS=19)															
4	23VL5101	MOS CIRCUIT DESIGN	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment

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5	23VL5102	DIGITAL VLSI DESIGN	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment
6	23VL5103	ANALOG IC DESIGN	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
7	23VL5203	LOW POWER VLSI SYSTEM DESIGN	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
8	23VL5104	ASIC AND FPGA DESIGN	R	PCC	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
OPEN ELECTIVE COURSES (CREDITS=03)															
9		PATENT LAWS FOR ENGINEERS & SCIENTISTS	M	OE	3	0	0	0	3	0			No		
PROJECT COURSES (CREDITS=38)															
10	23IE5201	ESSENTIALS OF RESEARCH DESIGN	R	PRI	1	1	0	0	2	2			No		

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11	23IE5149	TERM PAPER	R	PRI	0	0	8	0	4	4			No		
12	23IE6150/ 23IE6151	DISSERTATION or INTERNSHIP-1	R	PRI	0	0	32	0	16	24			No		
13	23IE6250/ 23IE6251	DISSERTATION OR INTERNSHIP-2	R	PRI	0	0	32	0	16	24			No		
VALUE ADDED COURSES (CREDITS=00)															
14		CERTIFICATION COURSE-1	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	No		Global certification course, helps better employment & for enterpreneurship
15		CERTIFICATION COURSE-2	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	No		Global certification course, helps better employment & for enterpreneurship
PROFESSIONAL ELECTIVE COURSES (CREDITS=16)															
16		PROFESSIONAL ELECTIVE - 1	R	PE-1	2	0	2	0	3	4					
17		PROFESSIONAL ELECTIVE - 2	R	PE-2	2	0	2	0	3	4					
18		PROFESSIONAL ELECTIVE - 3	R	PE-3	3	0	2	0	4	5					

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19		PROFESSIONAL ELECTIVE - 4	R/M	PE-4	3	0	0	0	3	3					
20		PROFESSIONAL ELECTIVE - 5	M	PE-5	3	0	0	0	3	0					
		TOTAL CREDITS			**37**	**3**	**96**	**0**	**80**	**110**					
LIST OF PROFESSIONAL ELECTIVES															
1	23EC5101	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	R	PE-1	2	0	2	0	3	4	ENTERPRENSHIP/EMPLOYABILITY	Case Studies based learning, Problem Solving	No		Project based course helps better employment & enterpreneurship
2	23VL5302	VLSI PHYSICAL DESIGN	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
3	23VL5301	MEMORY DESIGN AND TESTING	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
4	23VL5303	ADVANCED DIGITAL IC DESIGN	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment

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5	23VL5304	VLSI SIGNAL PROCESSING	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
6	23VL5401	TESTING OF VLSI CIRCUITS	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
7	23VL5503	NANO ELECTRONICS	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
8	23VL5501	MEMS SYSTEMS DESIGN	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
9	23VL5502	IC FABRICATION TECHNOLOGY	R	PE-4	3	0	0	0	3	3	ENTERPRENSHIP / EMPLOYABILITY	Practice based learning, Problem Solving	No		Project based course helps better employment & enterprenship

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10	23VL5504	SEMICONDUCTOR DEVICE MODELLING	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
11	23VL5505	BLOCK CHAIN & CYBER SECURITY	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
12	23VL5509M	SYSTEM ON CHIP DESIGN	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
13	23VL5506M	INTERNET OF THINGS ARCHITECTURE AND PROTOCOLS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
14	23VL5507M	VLSI CIRCUITS FOR BIO-MEDICAL APPLICATIONS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment

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15	23VL5508M	OPTIMIZATION TECHNIQUES IN VLSI DESIGN	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
16	23VL5510M	EMBEDED SYSTEM DESIGN	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
17	23VL5511M	FPGA-BASED WIRELESS SYSTEM DESIGN	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
18	23VL5512M	RF MIXED SIGNAL IC DESIGN	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment

No of new courses: 09

Total no of courses: 38

Percentage New courses: (09/38)*100 = 23.68%

Percentage of Courses Revised = (00/38) * 100 = 00%

Percentage of Program Syllabus Revision = (09/38)*100 = 23.68%

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DEPARTMENT OF ECE M.TECH – ROBOTICS & AUTOMATION – Y23 STRUCTURE															
S.No	**Course Code**	**Course Name**	**Mode**	**Cours**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**Activities/Content with direct bearing on Employability / Entrepreneurship/ Skill development**	**Course Category**	**New Cour se (Yes/ No)**	**Stake holder Feedb ack**	**Justification**
AUDIT COURSES (CREDITS=00)															
1	23UC5201	PROFESSIONAL COMMUNICATION SKILS	R	AU C	0	0	4	0	0	4					
2	23CS5001	OBJECT ORIENTED PROGRAMMING	R/M	AU C	0	0	4	0	0	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
ENGINEERING SCIENCE COURSES (CREDITS=04)															
3	23RA5001	NON-LINEAR SYSTEMS AND CONTROL OPTIMIZATION	R	ESC	2	2	0	0	4	4					
PROFESSIONAL CORE COURSES (CREDITS=19)															
4	23RA5101	ROBOTICS : CYBER PHYSICAL SYSTEMS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
5	23RA5102	IIOE 4.0 FOR AUTOMATION AND ROBOTIC SYSTEMS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment

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6	23RA5103	ALGORITHMS FOR ROBOTICS SENSOR FUSION	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
7	23RA5204	ADVANCED ROBOTIC WIRELESS SENSOR NETWORKS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment
8	23RA5105	AUTONOMOUS MOBILE ROBOTS AND AUTOMOTIVE ELECTRONICS	R	PCC	2	0	2	0	3	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Industry**	Project based course helps better employment
OPEN ELECTIVE COURSES (CREDITS=03)															
9		PATENT LAWS FOR ENGINEERS & SCIENTISTS	M	OE	3	0	0	0	3	0					
PROJECT COURSES (CREDITS=38)															
10	23IE5201	ESSENTIALS OF RESEARCH DESIGN	R	PRI	1	1	0	0	2	2					
11	23IE5149	TERM PAPER	R	PRI	0	0	8	0	4	4					
12	23IE6150/ 23IE6151	DISSERTATION or INTERNSHIP-1	R	PRI	0	0	32	0	16	24					
13	23IE6250/ 23IE6251	DISSERTATION OR INTERNSHIP-2	R	PRI	0	0	32	0	16	24					
VALUE ADDED COURSES (CREDITS=00)															

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14		CERTIFICATION COURSE-1	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	No		Global certification course, helps better employment & for enterprenship
15		CERTIFICATION COURSE-2	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	No		Global certification course, helps better employment & for enterprenship
PROFESSIONAL ELECTIVE COURSES (CREDITS=16)															
16		PROFESSIONAL ELECTIVE - 1	R	PE-1	2	0	2	0	3	4					
17		PROFESSIONAL ELECTIVE - 2	R	PE-2	2	0	2	0	3	4					
18		PROFESSIONAL ELECTIVE - 3	R	PE-3	3	0	2	0	4	5					
19		PROFESSIONAL ELECTIVE - 4	R/M	PE-4	3	0	0	0	3	3					
20		PROFESSIONAL ELECTIVE - 5	M	PE-5	3	0	0	0	3	0					
		TOTAL CREDITS			**37**	**3**	**96**	**0**	**80**	**110**					
LIST OF PROFESSIONAL ELECTIVES															
1	23EC5101	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	R	PE-1	2	0	2	0	3	4	ENTERPRENSHIP / EMPLOYABILITY	Case Studies based learning, Problem Solving			Project based course helps better employment & enterprenship

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2	23RA5301	ROBOTICS: DESIGN OF SENSORS, DRIVES AND ACTUATORS	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenship
3	23RA5302	AUTONOMOUS MOBILE ROBOT SYSTEMS	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment & enterprenship
4	23RA5401	HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenship
5	23RA5402	COMPUTER VISION & APPLICATIONS	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment & enterprenship
6	23RA5302	SWARM ROBOTICS CONTROL SYSTEMS	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenship

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7	23RA5502	SIGNAL PROCESSING FOR ROBOTICS	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment & enterprenship
8	23RA5601M	AUTOMOTIVE ELECTRONICS & AVIONICS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving			Project based course helps better employment & enterprenship
9	23RA5602M	DESIGN OF AUTOMATION SYSTEMS AND ASSISTIVE ROBOTIC SYSTEMS	M	PE-5	3	0	0	0	3	0	ENTERPRENSHIP/ EMPLOYABILITY	Case Studies based learning, Problem Solving			Project based course helps better employment & enterprenship

No of new courses: 06

Total no of courses: 29

Percentage New courses: (06/29)*100 = 20.68%

Percentage of Courses Revised = (00/29) * 100 = 00%

Percentage of Program Syllabus Revision = (06/29)*100 = 20.68%

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DEPARTMENT OF ECE
M. TECH - RADAR & COMMUNICATION - Y23 STRUCTURE

S.No	Course Code	Course Name	Mode	Course Cat	L	T	P	S	Cr	CH	Activities/Content with direct bearing on Employability / Entrepreneurship / Skill development	Course Category	New Course (Yes/ No)	Stakeholder Feedback	Justification
AUDIT COURSES (CREDITS=00)															
1	23UC5201	PROFESSIONAL COMMUNICATION SKILS	R	AUC	0	0	4	0	0	4					
2	23CS5001	OBJECT ORIENTED PROGRAMMING	R/M	AUC	0	0	4	0	0	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
ENGINEERING SCIENCE COURSES (CREDITS=04)															
3	23RA5001	NON-LINEAR SYSTEMS AND CONTROL OPTIMIZATION	R	ESC	2	2	0	0	4	4					
PROFESSIONAL CORE COURSES (CREDITS=19)															
4	23RC5101	WIRELESS COMMUNICATION AND DATA NETWORKS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment

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5	23RC5102	SMART ANTENNAS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
6	23RC5103	MODERN SATELLITE COMMUNICATION SYSTEMS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
7	23RC5205	5G NR - NEXT GENERATION WIRELESS TECHNOLOGIES	R	PCC	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
8	23RC5206	RF SYSTEM DESIGN	R	PCC	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment

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OPEN ELECTIVE COURSES (CREDITS=03)															
9		PATENT LAWS FOR ENGINEERS & SCIENTISTS	M	OE	3	0	0	0	3	0					
PROJECT COURSES (CREDITS=38)															
10	23IE5201	ESSENTIALS OF RESEARCH DESIGN	R	PRI	1	1	0	0	2	2					
11	23IE5149	TERM PAPER	R	PRI	0	0	8	0	4	4					
12	23IE6150/ 23IE6151	DISSERTATION or INTERNSHIP-1	R	PRI	0	0	32	0	16	24					
13	23IE6250/ 23IE6251	DISSERTATION OR INTERNSHIP-2	R	PRI	0	0	32	0	16	24					
VALUE ADDED COURSES (CREDITS=00)															
14		CERTIFICATION COURSE-1	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	Yes		Global certification course, helps better employment & for enterprenship
15		CERTIFICATION COURSE-2	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	Yes		Global certification course, helps better employment & for enterprenship

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PROFESSIONAL ELECTIVE COURSES (CREDITS=16)															
16		PROFESSIONAL ELECTIVE - 1	R	PE-1	2	0	2	0	3	4					
17		PROFESSIONAL ELECTIVE - 2	R	PE-2	2	0	2	0	3	4					
18		PROFESSIONAL ELECTIVE - 3	R	PE-3	3	0	2	0	4	5					
19		PROFESSIONAL ELECTIVE - 4	R/M	PE-4	3	0	0	0	3	3					
20		PROFESSIONAL ELECTIVE - 5	M	PE-5	3	0	0	0	3	0					
		TOTAL CREDITS			**37**	**3**	**96**	**0**	**80**	**110**					
LIST OF PROFESSIONAL ELECTIVES															
1	23RC5301	LIDAR & RADAR SYSTEM CONTROL	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship
2	23RC5302	INTERNET OF THINGS ARCHITECTURE AND PROTOCOLS	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship

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3	23RC5303	COMPUTER VISION & VIDEO SURVEILLANCE SYSTEMS	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship
4	23RC5304	REMOTE SENSING & SENSORS	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship
5	23RC5401	MACHINE LEARNING FOR WIRELESS COMMUNICATIONS	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship
6	23RC5402	PHASED ARRAY SYSTEMS	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship

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7	23RC5403	HIGH PERFORMANCE COMMUNICATION NETWORKING	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship
8	23RC5404	ESTIMATION & DETECTION THEORY	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship
9	23RC5501	MODERN RADARS & AUTONOMOUS VEHICLES	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship
10	23RC5502	OPTICAL WIRELESS COMMUNICATION	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship

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11	23RC5503	RF MIXED SIGNAL IC DESIG	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship
12	23RC5504	BLOCK CHAIN & CYBER SECURITY	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship
13	23RC5601M	FPGA-BASED WIRELESS SYSTEM DESIGN	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship
14	23RC5602M	EMI/EMC & ELECTRONIC WARFARE	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	**Academic Peer**	Project based course helps better employment & enterprenship

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15	23RC5603M	GPS & GLOBAL NAVIGATION SATELLITE SYSTEM	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship
16	23RC5604M	WIRELESS MULTIMEDIA COMMUNICATIONS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship
17	23RA5601M	AUTOMOTIVE ELECTRONICS & AVIONICS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	**No**	**Academic Peer**	Project based course helps better employment & enterprenship

No of new courses: 00

Total no of courses: 37

Percentage New courses: (00/37)*100 = 00%

Percentage of Courses Revised = (00/37 * 100 = 00%

Percentage of Program Syllabus Revision = (00*100)= 00%

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Annexure-II

M. Tech in Embedded Systems for Y23 Batch

DEPARTMENT OF ECE M.TECH – EMBEDDED SYSTEMS – Y23 STRUCTURE															
S.No	**Course Code**	**Course Name**	**Mode**	**Course Cat**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development**	**Course Category**	**New Course (Yes/ No)**	**Stakeholder Feedback**	**Justification**
AUDIT COURSES (CREDITS=00)															
1	23UC5201	PROFESSIONAL COMMUNICATION SKILS	R	AUC	0	0	4	0	0	4					
2	23CS5001	OBJECT ORIENTED PROGRAMMING	R/M	AUC	0	0	4	0	0	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	No		Project based course helps better employment
ENGINEERING SCIENCE COURSES (CREDITS=04)															
3	23RA5001	NON-LINEAR SYSTEMS AND CONTROL OPTIMIZATION	R	ESC	2	2	0	0	4	4					
PROFESSIONAL CORE COURSES (CREDITS=19)															

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4	23ES5101	EMBEDDED CONTROLLERS & SOCS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes		Project based course helps better employment
5	23ES5102	EMBEDDED HARDWARE AND SOFTWARE CO-DESIGN	R	PCC	3	0	2	0	4	5	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	Yes		Design course helps better employment & enterprenship
6	23ES5103	M2M TECHNOLOGY: IOT	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes		Project based course helps better employment
7	23ES5204	REAL TIME EMBEDDED SYSTEMS	R	PCC	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes		Project based course helps better employment
8	23ES5105	IOT SYSTEM DESIGN TECHNIQUES	R	PCC	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes		Project based course helps better employment
OPEN ELECTIVE COURSES (CREDITS=03)															

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9		PATENT LAWS FOR ENGINEERS & SCIENTISTS	M	OE	3	0	0	0	3	0					
PROJECT COURSES (CREDITS=38)															
10	23IE5201	ESSENTIALS OF RESEARCH DESIGN	R	PRI	1	1	0	0	2	2					
11	23IE5149	TERM PAPER	R	PRI	0	0	8	0	4	4					
12	23IE6150/23IE6151	DISSERTATION or INTERNSHIP-1	R	PRI	0	0	32	0	16	24					
13	23IE6250/23IE6251	DISSERTATION OR INTERNSHIP-2	R	PRI	0	0	32	0	16	24					
VALUE ADDED COURSES (CREDITS=00)															
14		CERTIFICATION COURSE-1	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	Yes		Global certification course, helps better employment & for enterprenship
15		CERTIFICATION COURSE-2	R/M	VAC	2	0	0	0	0	2	SKILL DEVELOPMENT/ ENTERPRENSHIP	Practice based learning, Case Studies based learning	Yes		Global certification course, helps better employment & for enterprenship
PROFESSIONAL ELECTIVE COURSES (CREDITS=16)															
16		PROFESSIONAL ELECTIVE - 1	R	PE-1	2	0	2	0	3	4					
17		PROFESSIONAL ELECTIVE - 2	R	PE-2	2	0	2	0	3	4					

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18		PROFESSIONAL ELECTIVE - 3	R	PE-3	3	0	2	0	4	5					
19		PROFESSIONAL ELECTIVE - 4	R/M	PE-4	3	0	0	0	3	3					
20		PROFESSIONAL ELECTIVE - 5	M	PE-5	3	0	0	0	3	0					
		TOTAL CREDITS			**37**	**3**	**96**	**0**	**80**	**110**					
LIST OF PROFESSIONAL ELECTIVES															
1	23ES5301	ADVANCED EMBEDDED SYSTEM DESIGN	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
2	23ES5302	DIGITAL TWINS MODEL-BASED EMBEDDED SYSTEMS	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
3	23ES5303	RECONFIGURABLE HARDWARE DESIGN	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship

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4	23ES5304	DATA BASES, DATA MODELLING & DATA STRUCTURE	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
5	23ES5401	ADVANCED EMBEDDED SOFTWARE DEVELOPMENT	R	PE-2	2	0	2	0	3	4	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
6	23ES5402	IOT & EDGE COMPUTING AND MOBILE APPLICATIONS	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
7	23ES5403	SYSTEM ON CHIP DESIGN	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship

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8	23ES5404	BLOCKCHAIN & CYBER SECURITY	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenership
9	23ES5501	INDUSTRIAL AUTOMATION SYSTEM DESIGN	R	PE-3	3	0	2	0	4	5	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenership
10	23ES5602	SYSTEMS FOR SMART CITY & SMART VILLAGE	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenership
11	23ES5503	MICRO- AND NANO-EMBEDDED SYSTEMS	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterprenership

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12	23ES5504	ENERGY HARVESTING TECHNOLOGIES FOR IOT	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
13	23ES5601	OPTIMIZATION ALGORITHMS FOR AUTONOMOUS SYSTEMS	R	PE-4	3	0	0	0	3	3	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
14	23ES5602M	IIOT 4.0 FOR AUTOMATION IN INDUSTRIES	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
15	23ES5603M	MEMS SENSORS AND ACTUATORS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship

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16	23ES5604M	CYBER-PHYSICAL SYSTEMS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
17	23RA5601M	AUTOMOTIVE ELECTRONICS & AVIONICS	M	PE-5	3	0	0	0	3	0	EMPLOYABILITY/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	**Yes**	**Academic Peer**	Project based course helps better employment & enterpreneurship
	Percentage of Program Syllabus Revision = 100%															

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Annexure-III

Syllabus revised/ New courses For Y23 B. Tech program

Syllabus New / Revision

1. **Program structure (with all Courses) containing the following categorization**

Course Code	Course Name	Course Category	L	T	P	S	CR	Pre-Requisite	New / Revised / Retained	Stakeholder Category	Justification for considering the feedback
23MT1001	Linear Algebra and Calculus for Engineers	BSC	2	2	0	0	4		New	Dr.Habibulla Khan, Professor, KLEF, Vijayawada	A basic mathematics course will cover essential topics such as calculus, linear algebra, and probability, which are crucial for success in technical fields. This course will bridge any gaps in students' mathematical understanding, providing them with the necessary tools to tackle both theoretical and practical problems in their core subjects.
23MT1002	Discrete Structures (Mathematic Elective - 1)	BSC	2	2	0	0	4		New	Dr.D.Sreenivasa Rao, Associate Professor, KLEF, Vijayawada	Some students may have gaps in their mathematical knowledge, which can hinder their ability to grasp more complex topics. A well-structured basic mathematics course will address these gaps, providing students with the tools they need to succeed in their specialized courses and research.
23MT2006	Optimization In Engineering (Mathematics Elective – 2)	BSC	2	2	0	0	4		New	Dr.I.Govardhani, Professor, KLEF, Vijayawada	Recent research trends indicate that optimization is integral to advancements in artificial intelligence, machine learning, signal processing, and various engineering applications. This course would provide students with the mathematical foundations necessary to engage with modern research and innovation in these areas.
23MT2007	Random Variable and Stochastic Process (Mathematics Elective – 3)	BSC	2	2	0	0	4		New	Dr.V.Rajesh, Professor, KLEF, Vijayawada	In various industries, including telecommunications, data science, and electronics, predictive models and probability theory are essential for analyzing and forecasting trends, improving system performance, and making informed decisions. This course will provide students with the

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											necessary skills to excel in roles that require analytical thinking and data-driven decision-making, thus enhancing their employability.
23EC1101	Fundamentals of IOT & Sensors	ESC	3	0	4	0	5		New	Dr.M.Sridhar, Professor, KLEF, Vijayawada	The course will benefit students across various engineering and technology disciplines, especially those in Electronics, Communication, Computer Science, and Electrical Engineering, by providing them with the foundational knowledge required to work with embedded systems and IoT.
23EC1203	BASIC ELECTRICAL & ELECTRONIC CIRCUITS	ESC	2	0	0	0	2		New	Dr.M. siva ganga prasad, Professor, KLEF, Vijayawada	By introducing this course, students across various engineering departments (such as Electronics and Communication, Computer Science, and Electrical Engineering) will gain crucial insights into circuit analysis and design, which are indispensable for projects involving embedded systems, IoT, sensors, and more. This cross-departmental relevance will encourage broader participation and foster interdisciplinary learning.
23UC0013	GLOBAL LOGIC BUILDING CONTEST PRACTICUM	AUC	0	0	0	2	2		New	Dr.B.T.P.Madhav, Professor, KLEF, Vijayawada	Stakeholder feedback highlights a growing gap between theoretical knowledge and practical application. By introducing code-based practical sessions, students will have hands-on experience in solving real-world problems using coding, which will bridge this gap. Competitions will further stimulate creative thinking and improve critical problem-solving skills under time constraints.
23UC0014	GLOBAL LOGIC BUILDING CONTEST PRACTICUM	AUC	0	0	0	2	2		New	Dr.M.Venkata Narayana , Professor, KLEF, Vijayawada	Competitive programming helps students develop critical thinking, algorithmic skills, and a deep understanding of data structures, all of which are highly valued in technical roles. Practical coding sessions will also allow students to gain proficiency in various programming languages and development tools, ensuring they are better prepared for job requirements in the industry.
23EC1202	DIGITAL DESIGN AND COMPUTER ARCHITECTURE	ESC	3	0	2	0	5		New	Dr.S. Koteswararao,	Digital electronics and computer architecture are foundational areas that support various disciplines, including electrical and electronics engineering, computer

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										Professor, KLEF, Vijayawada	science, and information technology. By introducing this course, students from diverse departments can gain essential knowledge that enhances their understanding of system design, computation, and digital systems—critical areas in both academic and professional settings.
23MB4068	Innovation Management	HAS	4	0	0	0	4		New	Dr.Aravind Kilaru, Associate Professor, KLEF, Vijayawada	The course will complement existing academic programs by equipping students with essential knowledge in sustainability, which is becoming increasingly relevant across multiple fields. This aligns with global educational trends, where institutions are prioritizing interdisciplinary approaches to solving complex societal challenges, such as climate change, resource depletion, and social inequality. The course will enhance students' ability to think critically and creatively about how their discipline can contribute to sustainable development.
23UC0027	LEADERSHIP AND MANAGEMENT SKILLS	HAS	0	0	4	0	4		New	Dr.Aravind Kilaru, Associate Professor, KLEF, Vijayawada	Leadership and management training prepares students for roles that require responsibility, whether in startups, established companies, or entrepreneurial ventures. It builds their capacity to lead teams, manage projects, and adapt to dynamic business environments.

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Syllabus revised courses for M. Tech (VLSI, RA, RC) Programs

Syllabus New / Revision

2. Program structure (with all Courses) containing the following categorization

Course Code	Course Name	Course Category	L	T	P	S	CR	Pre-Requisite	New / Revised / Retained	Stakeholder Category	Justification for considering the feedback
23RA5101	ROBOTICS: CYBER PHYSICAL SYSTEMS	Skill Development	3	0	2	0	5		Retained	Dr. M. Venkata Narayana, Professor, KLEF, Vijayawada	Stakeholders, including industry representatives, emphasize the importance of hands-on experience in preparing students for professional roles. Practical sessions focused on real-time applications simulate industry scenarios, equipping students with relevant skills that improve their employability.
23RA5102	IIOE 4.0 FOR AUTOMATION AND ROBOTIC SYSTEMS	Skill Development	3	0	2	0	5		Retained	Dr. K. Sarat Kumar, Professor, KLEF, Vijayawada	Stakeholders, including industry representatives, emphasize the importance of hands-on experience in preparing students for professional roles. Practical sessions focused on real-time applications simulate industry scenarios, equipping students with relevant skills that improve their employability.
23RA5103	ALGORITHMS FOR ROBOTICS SENSOR FUSION	Skill Development	3	0	2	0	5		Revised	Mr. Sravan Kumar Konijeti, Siemens EDA, Bengaluru, Alumni	Stakeholders, including industry representatives, have highlighted the need for graduates to possess practical skills that match workplace requirements. Including practical sessions ensures students gain real-world competencies, making them more employable.
23RA5105	AUTONOMOUS MOBILE ROBOTS AND AUTOMOTIVE ELECTRONICS	Skill Development	2	0	2	0	4		Revised	Mr. Srinivas Vedala, Apple Inc., Bengaluru, Industry Expert	The removal of tutorial sessions in favor of practicals ensures that the curriculum remains dynamic and relevant to stakeholders' needs, focusing on applied learning. Practical sessions facilitate active learning, allowing students to experiment and apply theoretical concepts, thereby improving retention and comprehension.
23RA5204	ADVANCED ROBOTIC WIRELESS SENSOR NETWORKS	Skill Development	3	0	2	0	5		Revised	Dr.K.Ch.Sri Kavya, Director (Alumni) and Professor, KLEF, Vijayawada	Tutorials often repeat theoretical content, while practical sessions offer unique learning experiences.

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23RA5301	ROBOTICS: DESIGN OF SENSORS, DRIVES AND ACTUATORS	Skill Development	2	0	2	0	4		Revised	Dr.K.S.Ramesh, Professor, KLEF, Vijayawada	Practical sessions provide hands-on experience, allowing students to apply theoretical knowledge in real-world scenarios. This bridges the gap between theoretical concepts and their practical application.
23RA5302	SWARM ROBOTICS CONTROL SYSTEMS	Skill Development	3	0	0	0	3		New	Dr. Anil Vuppala, Asst. Prof., IIIT Hyderabad	The elective course will be designed to address identified gaps in the current curriculum, ensuring students acquire the latest skills and knowledge to meet professional and research standards.
23RA5401	HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE	Skill Development	3	0	2	0	5		New	Dr.P.Venkat Vijay Kishore, Professor, KLEF, Vijayawada	This course bridges the gap between robotics and biomedical engineering, fostering interdisciplinary learning. It provides a unique opportunity for students to explore topics like surgical robotics, prosthetics, rehabilitation devices, and robotic-assisted diagnostics, which are not extensively covered in existing courses.
23VL5001	TRANSFORMATION TECHNIQUES, RANDOM VARIABLES & STOCHASTIC PROCESSES	Skill Development	2	2	0	0	4		New	Dr. Senthil Sivakumar, Asst. Prof., IIIT Tiruchirappalli	Industry feedback indicates that mathematical knowledge directly correlates with the ability to perform tasks such as signal integrity analysis, circuit simulation, and design optimization.
23VL5101	MOS CIRCUIT DESIGN	Skill Development	3	0	2	0	5		Revised	Dr. Md.Z Rahman, Professor, KLEF, Vijayawada	Practical skills are a prerequisite in today's competitive job market. By integrating more practical sessions, students will develop the competencies required to address real-world challenges, making them better prepared for internships, projects, and placements.
23VL5103	ANALOG IC DESIGN	Skill Development	3	0	2	0	5		Revised	Dr.K.Srinivasarao, Professor, KLEF, Vijayawada	Practical sessions offer students the opportunity to apply theoretical knowledge in a controlled, experiential environment. This approach enhances conceptual understanding, problem-solving skills, and the ability to work with real-world scenarios.
23VL5104	ASIC AND FPGA DESIGN	Skill Development	2	0	2	0	4		Revised	Dr. R. S. Ernest Ravindran, Associate	Incorporating more practical sessions aligns with the curriculum's objective to produce graduates who are not only knowledgeable but also adept in practical applications relevant to their field.

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23VL5202	ALGORITHMS FOR VLSI DESIGN AUTOMATION	Skill Development	0	0	4	0	4		Revised	Dr. Anil Vuppala, Asst. Prof., IIIT Hyderabad	Repeating the same theoretical content may not add value to the students' learning at the postgraduate level.
23VL5203	LOW POWER VLSI SYSTEM DESIGN	Skill Development	3	0	2	0	5		Revised	Dr. Senthil Sivakumar, Asst. Prof., IIIT Tiruchirappalli	Practical activities challenge students to apply their knowledge to solve real-world problems, thereby honing their critical thinking and problem-solving abilities, which are essential for their professional growth.
23VL5302	VLSI PHYSICAL DESIGN	Skill Development	2	0	2	0	4		New	Dr. V. S. V. Prabhakar, Director, Industry Connect, KLEF, Vijayawada	Currently, the curriculum focuses on foundational electronics and introductory VLSI concepts. Adding this course will bridge the gap between theoretical knowledge and industry-applicable skills.
23VL5401	TESTING OF VLSI CIRCUITS	Skill Development	3	0	2	0	5		Revised	Dr. K. Ch. Sri Kavya, Professor, KLEF, Vijayawada	Replacing tutorials with practical sessions fosters experiential learning, improving retention and understanding of concepts.
23VL5503	NANO ELECTRONICS	Skill Development	3	0	0	0	3		New	Mr. Sravan Kumar Konijeti, Siemens EDA, Bengaluru	The industry demand for professionals skilled in nanoelectronic technologies is on the rise, driven by innovations in areas such as VLSI design, MEMS/NEMS, and IoT-enabled devices.

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Course Code	Course Name	Course Category	Existing Syllabus (as per Annexure-3)	New Syllabus (as per Annexure-3)	Topics Added / Removed / Replaced	Change in Outcome	Justification for the Modification	*Overall Revision Percentage
23RA5101	ROBOTICS: CYBER PHYSICAL SYSTEMS	Skill Development	CO1: Structure and Functions of Cyber Physical Systems: Key Features of Cyber-Physical Systems-Synchronous Model-Safety Requirements-Asynchronous Model-Liveness Requirements-Dynamical Systems-Timed Model-Real-Time Scheduling CO2: Advanced Modeling and Simulation of Robotics cyber physical systems(RCPS):Modeling Physical Systems-Hybrid Systems -Control Theory-Modeling Computational Systems -Coordinate Transformation (Robot Arm)-Game Theory: The Role of Game Theory in CPS Design-Sensing and Actuation based on CPS-Design project. CO3: Drones as Cyber-Physical Systems:Introduction to the Fourth Industrial Revolution-Drone Flight Ready-Cyber Systems:Drone Cyber-Systems as CPS Components-Drone Assembly-radio control transmitter-radio communication-software-	CO1: Structure and Functions of Cyber Physical Systems: Key Features of Cyber-Physical Systems-Synchronous Model-Safety Requirements-Asynchronous Model-Liveness Requirements-Dynamical Systems- Timed Model-Real-Time Scheduling CO2: Advanced Modeling and Simulation of Robotics cyber physical systems(RCPS):Modeling Physical Systems-Hybrid Systems -Control Theory-Modeling Computational Systems - Coordinate Transformation (Robot Arm)-Game Theory: The Role of Game Theory in CPS Design-Sensing and Actuation based on CPS-Design project. CO3: Drones as Cyber-Physical Systems: Introduction to the Fourth Industrial Revolution-Drone Flight Ready-Cyber Systems: Drone Cyber-Systems as CPS Components-Drone Assembly-radio control transmitter-radio communication-software-	**No change**	**No change**	**Stakeholders, including industry representatives, emphasize the importance of hands-on experience in preparing students for professional roles. Practical sessions focused on real-time applications simulate industry scenarios, equipping students with relevant skills that improve their employability.**	**0**

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			sensors in CPS-Location Sensor-image sensors-Valuing Cyber-Physical Bridging Intensity of Drone - Futurology and Future Prospect of Drone CPS CO4: Practical Introduction to Human-in-the-Loop Cyber-Physical Systems:Humans as Elements of Cyber-Physical Systems- Evolution of HiTL Technologies- Theory of HiTLCPSs- Human-in-the-Loop: Hands-On- Future of Human-In-the-Loop Cyber-Physical Systems Case Study Cooperative and Autonomous Systems with cyber-physical systems Teamwork: Design a Robotics cyber-physical system verify with robotics software's. CO5: RCPS LAB Simulation practice on Modeling of Robotics Cyber-Physical Systems	sensors in CPS-Location Sensor-image sensors-Valuing Cyber-Physical Bridging Intensity of Drone - Futurology and Future Prospect of Drone CPS CO4: Practical Introduction to Human-in-the-Loop Cyber-Physical Systems: Humans as Elements of Cyber-Physical Systems- Evolution of HiTL Technologies- Theory of HiTLCPSs- Human-in-the-Loop: Hands-On- Future of Human-In-the- Loop Cyber-Physical Systems Case Study Cooperative and Autonomous Systems with cyber-physical systems Teamwork: Design a Robotics cyber-physical system verify with robotics software's. CO5: RCPS LAB Simulation practice on Modeling of Robotics Cyber-Physical Systems				
23RA5102	IIOE 4.0 FOR AUTOMATION AND ROBOTIC SYSTEMS	Skill Development	CO-1: Overview of Robotic and automation Industrial IoT (IIoT) 4.0: Industry 4.0 and 5.0 Basic terms – Ecosystem IOT and IIOT -History of IIOT 4.0-Components of IIOT-Robotics Industry IoT 5.0 sensing and process systems -Business Models and Reference Architecture of	CO-1: Overview of Robotic and automation Industrial IoT (IIoT) 4.0: Industry 4.0 and 5.0 Basic terms – Ecosystem IOT and IIOT -History of IIOT 4.0-Components of IIOT-Robotics Industry IoT 5.0 sensing and process systems -Business Models and Reference Architecture of	**No change**	**No change**	**Stakeholders, including industry representatives, emphasize the importance of hands-on experience in preparing students for professional roles. Practical sessions**	**0**

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			IIoT-Challenges & Benefits in implementing IIOT 4.0-Business Models and Reference Architecture of IIoT -Service Level Agreement of IIOT 4.0-Characteristics of robotics and automation industry 4.0 IOT. CO-2: Robotic Industry IOT Devices: IIOT based Sensors and Actuators, Categories, Functionality, and characteristics- Industrial Data Transmission: Foundation Fieldbus, profibus, HART, Interbus, Bitbus, DigitalSTROM, CAN, DeviceNet, LoRaandLoRaWAN. Industrial Data Acquisition: Distributed Control System-PLC-SCADA –Factory IIoT Analytics: Sentinel for Industrial Robots IoT 5.0-Categorization of analytics: IIoT and Industry 4.0 context-Mapping of analytics with the IIRA architecture-Discovering OPC CO-3: Cognitive Sensors and IoT4.0: Introduction to Cognition in IoT-Information-Centric Sensor Networks-for Cognitive IoT-Cognitive-Node Architecture	IIoT-Challenges & Benefits in implementing IIOT 4.0-Business Models and Reference Architecture of IIoT -Service Level Agreement of IIOT 4.0-Characteristics of robotics and automation industry 4.0 IOT. CO-2: Robotic Industry IOT Devices: IIOT based Sensors and Actuators, Categories, Functionality, and characteristics- Industrial Data Transmission: Foundation Fieldbus, profibus, HART, Interbus, Bitbus, DigitalSTROM, CAN, DeviceNet, LoRaandLoRaWAN. Industrial Data Acquisition: Distributed Control System-PLC-SCADA –Factory IIoT Analytics: Sentinel for Industrial Robots IoT 5.0-Categorization of analytics: IIoT and Industry 4.0 context-Mapping of analytics with the IIRA architecture-Discovering OPC CO-3: Cognitive Sensors and IoT4.0: Introduction to Cognition in IoT-Information-Centric Sensor Networks-for Cognitive IoT-Cognitive-Node Architecture			**focused on real-time applications simulate industry scenarios, equipping students with relevant skills that improve their employability.**	

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			and a Deployment Strategy for the Future Sensor Networks- A Data Delivery Framework for Cognitive Information-Centric Sensor Networks in Smart Outdoor Monitoring- Cognitive Routing Protocol for Disaster-Inspired WSNs on the Internet of Things- Fog-Based Caching and Learning for Information-Centric Networks-M2M To IOT - M2M Vs IOT – A vision from M2M to IOT – Case Study CO-4: Collaborative Man and Machine Workforce (IIoT 4.0): Technological Architecture Collaborative Robots in Industry 5.0- Robotics Modeling and Design: Mathematical Model of a Swarm Robotic-System with Wireless Bi-directional- Energy Transfer -Machine Learning and Deep Learning in Industries IOT 5.0-Pareto Optimal Solutions and Their- Application in Designing Robots-and Robotic Systems. Collaborative Robotics IOT 5.0: Control and Ergonomic Problems of Collaborative Robotics-Human-Robot Interaction Efficiency and	and a Deployment Strategy for the Future Sensor Networks- A Data Delivery Framework for Cognitive Information-Centric Sensor Networks in Smart Outdoor Monitoring- Cognitive Routing Protocol for Disaster-Inspired WSNs on the Internet of Things- Fog-Based Caching and Learning for Information-Centric Networks-M2M To IOT - M2M Vs IOT – A vision from M2M to IOT – Case Study CO-4: Collaborative Man and Machine Workforce (IIoT 4.0): Technological Architecture Collaborative Robots in Industry 5.0- Robotics Modeling and Design: Mathematical Model of a Swarm Robotic-System with Wireless Bi-directional- Energy Transfer -Machine Learning and Deep Learning in Industries IOT 5.0-Pareto Optimal Solutions and Their- Application in Designing Robots-and Robotic Systems. Collaborative Robotics IOT 5.0: Control and Ergonomic Problems of Collaborative Robotics-Human-Robot Interaction Efficiency and				

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			Human-Robot Collaboration - Human-Robot Cooperation in Technological Wall Climbing Robot-Features of Human-Exoskeleton Interaction System-Analysis of Dynamics in Human Exoskeleton Collaborative System-Design studies on Siemens Melds Mendix with Mind Sphere to Boost IIoT Development.	Human-Robot Collaboration - Human-Robot Cooperation in Technological Wall Climbing Robot-Features of Human-Exoskeleton Interaction System-Analysis of Dynamics in Human Exoskeleton Collaborative System-Design studies on Siemens Melds Mendix with Mind Sphere to Boost IIoT Development.				
23RA5103	ALGORITHMS FOR ROBOTICS SENSOR FUSION	Skill Development	Introduction, sensors and sensor data, Use of multiple sensors, Fusion applications. The inference hierarchy: output data. Data fusion model. Architectural concepts and issues. Benefits of data fusion, Mathematical tools used: Algorithms, co-ordinate transformations, rigid body motion. Dependability and Markov chains, Meta - heuristics.fusion: Taxonomy of algorithms for multisensory data fusion. Data association. Identity declaration Estimation: Kalman filtering, practical aspects of Kalman filtering, extended Kalman filters. Decision levels identify fusion. Knowledge based approaches. Information	Introduction, sensors and sensor data, Use of multiple sensors, Fusion applications. The inference hierarchy: output data. Data fusion model. Architectural concepts and issues. Benefits of data fusion, Mathematical tools used: Algorithms, co-ordinate transformations, rigid body motion. Dependability and Markov chains, Meta - heuristics. Algorithms for data fusion: Taxonomy of algorithms for multisensory data fusion. Data association. Identity declaration Estimation: Kalman filtering, practical aspects of Kalman filtering, extended Kalman filters. Decision levels identify fusion. Knowledge based approaches Sensor	**Modified LTPS - 3000 to 3020 Add the Practical session using MATLAB**	**Add the CO5**	**Stakeholders, including industry representatives, have highlighted the need for graduates to possess practical skills that match workplace requirements. Including practical sessions ensures students gain real-world competencies, making them more employable.**	**20**

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			filter, extended information filter. Decentralized and scalable decentralized estimation. Sensor fusion and approximate agreement. Optimal sensor fusion using range trees recursively. Distributed dynamic sensor fusion. Structures:Tessellated, trees, graphs, and function. Representing ranges and uncertainty in data structures. Designing optimal sensor systems within dependability bounds. Implementing data fusion system-3D Sensing and Sensor Fusion: Introduction to Lidar and Point Clouds- Point Cloud Segmentation- Clustering Obstacles-Camera Based 2D Feature Tracking- Track an Object in 3D Space-Combining Camera and Lidar- Radar Target Generation and Detection Teamworks: Design studies and Unscented Kalman Filter Highway Project based on Machine Learning, Deep Neural networks sensor fusion algorithms.	Fusion Filters: Data information filter, extended information filter. Decentralized and scalable decentralized estimation. Sensor fusion and approximate agreement. Optimal sensor fusion using range trees recursively. Distributed dynamic sensor fusion. High Performance Data Structures: Tessellated, trees, graphs, and function. Representing ranges and uncertainty in data structures. Designing optimal sensor systems within dependability bounds. Implementing data fusion system-3D Sensing and Sensor Fusion: Introduction to Lidar and Point Clouds- Point Cloud Segmentation- Clustering Obstacles-Camera Based 2D Feature Tracking- Track an Object in 3D Space-Combining Camera and Lidar-Radar Target Generation and Detection				
23RA5105	AUTONOMOUS MOBILE ROBOTS	Skill Development	CO1_Introduction: Outdoor Mobile Robots-Mechanism Robot locomotion: Types of	CO_1: Introduction: Outdoor Mobile Robots-Mechanism Robot locomotion: Types of	**Modified LTPS - 3120 to 2020**	**Remove the tutorial session**	**The removal of tutorial sessions in favor of practicals**	32

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	AND AUTOMOTIVE ELECTRONICS		locomotion, hopping robots, legged robots, wheeled robots, stability, manoeuvrability, controllability. Mobile robot kinematics and dynamics: Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots. Motion Control: Cooperative Motion control land sensing Architecture- kinematic Motion Control Sensory System: basic terms-relative position sensor-first tier data fusion-second tier data fusion-static testing of the RPS-Testing of the RPS and data fusion CO2_Robust Motion Control: kinematic and dynamic models-single axle nonlinear damping control design-multi axle distributed control design - controller evaluation Perception: Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning	locomotion, hopping robots, legged robots, wheeled robots, stability, manoeuvrability, controllability. Mobile robot kinematics and dynamics: Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots. Motion Control: Cooperative Motion control land sensing Architecture kinematic Motion Control Sensory System: basic relative position sensor-first tier data fusion-second tier data fusion-static testing of the RPS-Testing of the RPS and data fusion. CO_2: Robust Motion Control: kinematic and dynamic models axle nonlinear damping control design-multi axle distributed control design - controller evaluation. Perception: Proprioceptive/Exteroceptive and passive/active sensors, performance measures of sensors, sensors for mobile robots like global positioning system (GPS), Doppler effect-			**ensures that the curriculum remains dynamic and relevant to stakeholders' needs, focusing on applied learning. Practical sessions facilitate active learning, allowing students to experiment and apply theoretical concepts, thereby improving retention and comprehension.**	

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			system (GPS), Doppler effect-based sensors, vision-based sensors, uncertainty in sensing, filtering. CO3_ Localization: Terrain inclination based localization and mapping – Odo metric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon systems; Introduction to planning and navigation: path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP),stochastic dynamic programming (SDP); Planning and Cloud based localization architecture in large scale environments: basics-cloud based outsourcing localization architecture-cloud based localization algorithms-Design project CO4_Embedded to Automotive Electronics and autonomous Vehicles	based sensors, vision-based sensors, uncertainty in sensing, filtering. CO_3: Localization: Terrain inclination-based localization and mapping – Odo metric position estimation, belief representation, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon systems. Introduction to planning and navigation: path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP). Planning and Cloud based localization architecture in large scale environments: basics-cloud based outsourcing localization architecture-cloud based localization algorithms-Design project. CO_4: Embedded to Automotive Electronics and autonomous Vehicles Fundamentals of Automotive Electronics				

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			Fundamentals of Automotive Electronics (FAE)-Advanced driver- assistance systems-Controlled Area Network (CAN)-Local Interconnect Network (LIN) -Flex Ray Consortium -Media Oriented Systems Transport (MOST)-Vehicle Area Network (VAN)-Integrated to Automotive Electronic Protocols: EBD, Electronics stability programs (ESP)-OPC, Remotely Piloted Vehicles (RPVs)-UAV-Vehicle Networking & Diagnostics Stacks; Automotive Functional Testing: The Process Flow-diagram. HIL Testing, MIL Testing, SIL Testing. Navigation Robotics Design Project: Students will work on a semester long project consisting of design, fabrication, and programming a mobile robotic platform.	(FAE)-Advanced driver assistance systems-Controlled Area Network (CAN)-Local Interconnect Network (LIN) -Flex Ray Consortium - Media Oriented Systems Transport (MOST)- Vehicle Area Network (VAN)- Integrated to Automotive Electronic Protocols: EBD, Electronics stability programs (ESP)-OPC, Remotely Piloted Vehicles (RPVs)-UAV-Vehicle Networking & Diagnostics Stacks; Automotive Functional Testing: The Process Flow-diagram. HIL Testing, MIL Testing, SIL Testing. Navigation Robotics Design Project: Students will work on a semester-long project consisting of the design, fabrication, and programming of a mobile robotic platform				
23RA5204	ADVANCED ROBOTIC WIRELESS SENSOR NETWORKS	Skill Development	CO1_Basic Robots Advancement: Anatomy of Robot-principles and Laws-brief history-Advancement in Degrees of Freedom (DoF): 6DOF,16DOF-Actuators and Drives-Control Components-Kinematics-Differential	CO1: Basic Robots Advancement: Anatomy of Robot, principles and Laws, brief history, Advancement in Degrees of Freedom (DoF): 6DOF, 16DOF, Actuators and Drives, Control Components, Kinematics, Differential	**Modified LTPS - 3120 to 3020**	**Remove the tutorial session**	**Tutorials often repeat theoretical content, while practical sessions offer unique learning experiences.**	**15**

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			Motion-Statics, Energy Method-Hybrid Position-force Control-Compliance, End-effecter Design-Non-holonomic Systems-Legged Robots, Multi-fingered Hands- Dynamics-Computed Torque Control-Computer Vision- Navigation-Tele-robotics and Virtual Reality. CO2_Advances in Robotic Kinematics: Facts and thoughts-Forward Kinematics 4-1CableDriven Parallel Robot-Inverse KinematicsConvergingPaths Algorithm-1DoF 7-R Closed Loop-Linkage as a Building Block of Nanorobots- Bennett Based Balanced Butterfly LinkAge-CooperativeObject-Manipulation Through a Heterogeneous Mobile-Multi-robot System-Robust Trajectory Planning of Under-Actuated-Cable-Driven Parallel Robot with 3 Cables-Kinematic Synthesis Modified Jansen LegMechanism-Kinematics and Orientation Workspace3-DOF Parallel Robotic Wrist-Actuated Spherical Four-Bar Linkages-Real-Time Motion-Planning	Motion, Statics, Energy Method, Hybrid Position, force Control, Compliance, End-effecter Design, Non-holonomic Systems, Legged Robots, Multi-fingered Hands - Dynamics, Computed Torque Control, Computer Vision, Navigation-Tele-robotics and Virtual Reality. CO2: Advances in Robotic Kinematics: Facts and thoughts, Forward Kinematics, 4-1 Cable-Driven Parallel Robot, Inverse Kinematics, Converging Paths Algorithm-1DoF 7-R Closed Loop-Linkage as a Building Block of Nanorobots- Bennett Based Balanced Butterfly LinkAge-Cooperative, Object-Manipulation Through a Heterogeneous Mobile-Multi-robot System-Robust Trajectory Planning of Under-Actuated-Cable-Driven Parallel Robot with 3 Cables-Kinematic Synthesis Modified Jansen Leg Mechanism-Kinematics and Orientation Workspace3-DOF Parallel Robotic Wrist-Actuated Spherical Four-Bar Linkages-Real-Time Motion-				

			DynamicEnvironments via EnhancedVelocity Obstacle-Design Project verification on robot simulator CoppeliaSim. CO3_Varieties of Robots & Advanced Robotics Heterogeneity: Design Studies on Boston Dynamics Products: Cheetah, Atlas, SpotMini, Legged Robots, Wheeled Robots, Mobile Robots, Telerobots, Service Robots; Design considerations On: Large Robots, Miniature Robot(Swarm robotics), Auto-bots, Swarm-Robotics, Micro-bots, wheeled mobile robots, bipeds,KUKA Collaborative Robot Serie, autonomous Underwater Vehicle, Unmanned Aerial Vehicle; Reactor Pressure Vessel (RPV) Measuring Robots, Introduction to Autonomous Electric Vehicles(AEVs)- Design Project verification on robot simulator CoppeliaSim. CO4_Robotic Wireless Sensor Networks: Basic terms of RWSN-Architecture - working principles of RWSN-robotics Router- RSSI Models, Measurements, and	Planning Dynamic Environments via Enhanced Velocity Obstacle-Design Project verification on robot simulator Coppelia Sim. CO3: Varieties of Robots & Advanced Robotics Heterogeneity: Design Studies on Boston Dynamics Products: Cheetah, Atlas, Spot Mini, Legged Robots, Wheeled Robots, Mobile Robots, Telerobots, Service Robots; Design considerations On Large Robots, Miniature Robot(Swarm robotics), Auto-bots, Swarm-Robotics, Micro-bots, wheeled mobile robots, bipeds, KUKA Collaborative Robot Serie, autonomous Underwater Vehicle, Unmanned Aerial Vehicle; Reactor Pressure Vessel (RPV) Measuring Robots, Introduction to Autonomous Electric Vehicles(AEVs)- Design Project verification on robot simulator Coppelia Sim. CO4: Robotic Wireless Sensor Networks: Basic terms of RWSN-Architecture - working principles of RWSN-robotics Router- RSSI				

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			RF mapping- RWSN Systems Components- Communication Aware Robot Positioning and Movement Control- RWSN Network Stack Layer Analysis. Case Studies:IoT and Wireless Sensor Network based Autonomous Farming Robot.	Models, Measurements, and RF mapping- RWSN Systems Components- Communication Aware Robot Positioning and Movement Control- RWSN Network Stack Layer Analysis. Case Studies: IoT and Wireless Sensor Network based Autonomous Farming Robot.				
23RA5301	ROBOTICS: DESIGN OF SENSORS, DRIVES AND ACTUATORS	Skill Development	Introduction to Robot Sensors -Definition, types, merits, and Internal Sensors and External Sensors, and operations- Optical Encoder-Basic elements of other position sensor: Potentiometer, - Levels of Velocity Measurement - Process, Inertial Sensors, Applications of Gyroscopes, -An overview of Accelerometer, - Fundamentals of Force Sensors, Torque Sensor, Range Sensors, IR Range Sensors, Limitations of Infrared Sensors, Time of Flight Range Sensors. Ultrasonic Sensors: Introduction Ultrasonic Sensors; Determining Limitations of Ultrasonic Sensors; Laser Ranger Finder: Example (Laser Range Finder), Vision, Stereo	Introduction to Robot Sensors -Definition, types, merits, and Internal Sensors and External Sensors, and operations- Optical Encoder-Basic elements of Other position sensor: Potentiometer, - Levels of Velocity Measurement - Process, Inertial Sensors, Applications of Gyroscopes, -An overview of Accelerometer, - Fundamentals of Force Sensors, Torque Sensor, Range Sensors, IR Range Sensors, Limitations of Infrared Sensors, Time of Flight Range Sensors. Ultrasonic Sensors: Introduction Ultrasonic Sensors; Determining Limitations of Ultrasonic Sensors; Laser Ranger Finder: Example (Laser Range Finder), Vision, Stereo	**Modified LTPS - 3000 to 2020**	**Add the CO5**	**Practical sessions provide hands-on experience, allowing students to apply theoretical knowledge in real-world scenarios. This bridges the gap between theoretical concepts and their practical application.**	**28**

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			Vision, and Proximity Sensors, Infrared (IR) Detector, Touch Sensors, Tactile Sensors Robot Actuators and Industrial Robots: Study of Basic Functionality of Robot Actuators, Operations of Electrical actuators; Robotics Hydraulic actuators in Advanced Automation; Pneumatic actuators in conveyor Belts operations, robots in industry real time embedded systems, Industrial Robots: Approach Manipulators by Using Visual; Tracking Over a Distributed System; Baggage Collection Automation Applications for Human Safety: Dangerous domains for humans, (Mine Detection), Hazardous domains for humans (chemical fumes etc.), Nuclear Biological Chemical warfare, dangerous exploratory missions UAVs, unmanned Rockets, Mars Mission, Chandrayaan. Introduction to Motors and Drives: Fundamentals of Motors, T DC Motors; Stepping Motors, Principles	Vision, and Proximity Sensors, Infrared (IR) Detector, Touch Sensors, Tactile Sensors. Robot Actuators and Industrial Robots: Study of Basic Functionality of Robot Actuators, Operations of Electrical actuators; Robotics Hydraulic actuators in Advanced Automation; Pneumatic actuators in conveyor Belts operations, robots in industry real time embedded systems, Industrial Robots: Approach Manipulators by Using Visual; Tracking Over a Distributed System; Baggage Collection Automation Applications for Human Safety: Dangerous domains for humans, (Mine Detection), Hazardous domains for humans (chemical fumes etc.), Nuclear Biological Chemical warfare, dangerous exploratory missions UAVs, unmanned Rockets, Mars Mission, Chandrayaan. Introduction to Motors and Drives: Fundamentals of Motors, T DC Motors; Stepping Motors, Principles				

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			of Servo Motors, Working Definition of Motion Transmission, Gear Ratio, Functionality of the Harmonic Drive, feature and limitation drive; Axis drive arrangements, ball screw, timing belts and couplings, Analog and digital drives. AC&DC servomotors, DC and AC servo drives for axis motors, servo tuning. Stepper motors and drives, spindle motors & drivesDC &AC. Selection criteria, drive optimization and protection	of Servo Motors, Working Definition of Motion Transmission, Gear Ratio, Functionality of the Harmonic Drive, feature and limitation drive; Axis drive arrangements, ball screw, timing belts and couplings, Analog and digital drives. AC&DC servomotors, DC and AC servo drives for axis motors, servo tuning. Stepper motors and drives, spindle motors & drives DC &AC. Selection criteria, drive optimization and protection.				
23VL5101	MOS CIRCUIT DESIGN	Skill Development	Introduction: Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules. MOS Transistor and Circuit Modeling: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry	Introduction: Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules. MOS Transistor and Circuit Modeling: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry	**Modified LTPS - 3120 to 3020**	**Remove the tutorial session no updating in outcomes**	**Practical skills are a prerequisite in today's competitive job market. By integrating more practical sessions, students will develop the competencies required to address real-world challenges, making them better prepared for internships, projects, and placements.**	**15**

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			effects, MOSFET capacitances, Modeling of MOS transistor using SPICE. MOS Inverter static characteristics and Interconnect Effects: Introduction, Resistive-Load Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters. Combinational and Sequential MOS logic Circuits: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bistable elements, SR latch circuit, clocked latch and flip-flop circuits, CMOS D-latch and Edge-triggered flip-flop. Dynamic logic Circuits: Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques,	effects, MOSFET capacitances, Modeling of MOS transistor using SPICE. MOS Inverterstatic characteristics and Interconnect Effects: Introduction, Resistive-Load Inverter, Inverter with n-typeMOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design withDelay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, SwitchingPower Dissipation of CMOS Inverters. Combinational and Sequential MOS logic Circuits: Introduction,MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOStransmission gates (Pass gates), Behavior of bistable elements, SR latch circuit, clocked latch and flip-flopcircuits, CMOS D-latch and Edge-triggered flip-flop. Dynamic logic Circuits: Basic principles of passtransistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques,				

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			Dynamic CMOS circuit techniques, High-performance dynamic CMOS circuits.	Dynamic CMOS circuittechniques, High-performance dynamic CMOS circuits.				
23VL5103	ANALOG IC DESIGN	Skill Development	Introduction to Analog IC Design & MOS Devices Modelling: Introduction to Analog IC Design,The Design Flow of Analog ICs, IC components and their models, Small Signal & large signal Models ofMOSFET.MOS Switch, MOS Diode, MOS Active Resistor, Layout considerations. Noise in MOS transistors and models. MOS Current Mirrors: Current Sinks and Sources, Basic Current Mirrors, WilsonCurrent Mirror, Cascode and modified Cascode current Mirror. Current and Voltage References, Band gap Reference. MOS Amplifiers: Basic considerations of amplifier design, Single Stage (CS, CG, CD)amplifiers, Cascode Stage; Basic Differential Pair, Differential Amplifiers, Cascode Amplifiers, Differentialpair with MOS loads, frequency response (miller effect) of	The preamble to Analog VLSI: Basic MOS Device physics: MOSFET operation, Drain current equation, MOSFET large and small signal models, second order effects. Single Stage Amplifiers: Introduction, Common source stage - Source follower- Common gate stage - Cascode stage. The single-ended and differential operation, Common mode response, differential pair with MOS loads, Gilbert Cell. Biasing Circuits: Basic current mirrors, cascode current mirrors, - voltage references, supply independent biasing - temperature independent references-PTAT current generation- Constant-Gm Biasing. Basic differential pair- Differential pair with MOS loads and active current mirrors. Operational amplifier stability and Frequency compensation: General Considerations, One and Two Stage Op Amps, Gain	**Modified LTPS - 3120 to 3020**	**Remove the tutorial session no updating in outcomes**	**Practical sessions offer students the opportunity to apply theoretical knowledge in a controlled, experiential environment. This approach enhances conceptual understanding, problem-solving skills, and the ability to work with real-world scenarios.**	**15**

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			CG, CS, CD. MOS Operational Amplifiers:Design of CMOS Op Amps, Compensation of Op Amps, Single-stage Op Amp, Cascode Op Amp Design ofTwo-Stage Op Amps, Basic two-stage MOS operational amplifier, MOS Folded –cascode operational amplifiers. MOS Filters and Nonlinear Analog circuits: Continuous time filters, Active RC filters using integrators, switched capacitor filters, switched capacitor filters using the bilinear transformation, phased locked loops, switched capacitor integrator, oscillators, ADC, DAC.	Boosting, Comparison, Common mode feedback, Input range limitations, Slew rate, Power Supply Rejection, Noise in Op Amps, General consideration of stability and frequency compensation, Multipole system: Phase margin, Frequency compensation, Compensation of two-stage op Amps, Other compensation techniques. Frequency response of amplifiers and Noise: General considerations, Miller Effect and Association of Poles with Nodes, Common source stage, Source followers, Common gate stage, Cascode stage, Differential pair. Noise: Statistical characteristics of noise, Types of noise, Representation of noise in circuits, Noise in single-stage amplifiers, Noise in differential pairs, and Noise Bandwidth. Feedback: General Consideration of feedback circuits, Feedback topologies, the effect of loading, and the effect of feedback on Noise. Nonlinear Analog circuits & other applications: Precision rectification, phased locked				

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				loops, Sampling Switches, switched capacitor integrator, oscillators, ADC, DAC.				
23VL5104	ASIC AND FPGA DESIGN	Skill Development	Introduction to ASICs: Types of ASICs, Design flow, Economic s of ASICs, ASIC cell libraries – CMOS logic cell- data path logic cells – I/O cells – c ell compilers. Programmable ASICs: The Antifuse, Static RAM, EPROM and EEPROM. MOS Programmable Logic Device (PLD); Digital System Design Automation with VHDL: Entity Declaration, Architecture Body, Configuration and Package Declaration, Basic Language elements, Behavioral, Dataflow and Structural Modeling. Programmable Logic to ASICs: PROM, PLAs, PALs, Masked Gate Array ASICs, CPLDs and FPGAs. Complex Programmable Logic Devices: CPLD Architecture, Function Block, I/O Blocks, Clock Drivers, Inter Connect, Embedded Devices. Field Programmable Gate Arrays: FPGA Architecure, Configurable Logic Block, Configurable I/O Block,	CO-1: Introduction to ASICs: Types of ASICs, Design flow, Economics of ASICs, ASIC cell libraries –CMOS logic cell- data path logic cells – I/O cells – cell compilers. Programmable ASICs: The Antifuse, Static RAM, EPROM and EEPROM. MOS Programmable Logic Device (PLD). CO-2: Digital System Design Automation with VHDL: Entity Declaration, Architecture Body, Configuration and Package Declaration, Basic Language elements, Behavioral, Dataflow and Structural Modeling. CO-3: Programmable Logic to ASICs:PROM, PLAs, PALs, Masked Gate Array ASICs, CPLDs and FPGAs. Complex Programmable Logic Devices: CPLD Architecture, Function Block, I/O Blocks, Clock Drivers, Inter Connect, Embedded Devices. Field Programmable Gate Arrays: FPGA Architecure, Configurable Logic Block, Configurable I/O Block,	**Modified LTPS - 3000 to 2020**	**Adding CO5**	**Incorporating more practical sessions aligns with the curriculum's objective to produce graduates who are not only knowledgeable but also adept in practical applications relevant to their field.**	**28**

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			Embedded Devices, Programmable Interconnect, Clock circuitry, SRAM Vs Antifuse Programming. Programmable ASIC Logic Cells: Actel ACT, Xilinx LCA, Altera FLEX, Altera MAX. ASIC Construction: Physical Design FPGA partitioning, Partitioning Methods. Floor Planning & Placement: Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools, I/O and Power planning, Clock planning, Placement terms and definitions, Placement Algorithms. Routing: Global routing, Detailed routing, special routing.	Embedded Devices, Programmable Interconnect, Clock circuitry, SRAM Vs Antifuse Programming. Programmable ASIC Logic Cells: Actel ACT, Xilinx LCA, Altera FLEX, Altera MAX. CO-4: ASIC Construction:Physical Design FPGA partitioning, Partitioning Methods. Floor Planning & Placement: Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools, I/O and Power planning, Clock planning, Placement terms and definitions, Placement Algorithms. Routing: Global routing, Detailed routing, special routing.				
23VL5202	ALGORITHMS FOR VLSI DESIGN AUTOMATION	Skill Development	Introduction to Design Methodologies: Design Automation tools, Algorithmic Graph Theory, Computational Complexity, Tractable and Intractable Problems Layout: Compaction, Placement, Floor planning and Routing Problems, Concepts and Algorithms Modeling: Gate Level Modeling and Simulation, Switch level	Introduction to Design Methodologies: Design Automation tools, Algo-rithmic Graph Theory, Computational Complexity, Tractable and Intractable Problems: Compaction, Placement, Floor planning and Routing Problems, Concepts and Algorithms Modeling: Gate Level Modeling and Simulation, Switch level modeling and	**Modified LTPS - 3020 to 0040**	**Removing the CO4 and 5 and updating the CO1, 2 and 3**	**Repeating the same theoretical content may not add value to the students' learning at the postgraduate level.**	**35**

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			modeling and simulation, Basic issues and Terminology, Binary – Decision diagram, Two – Level Logic Synthesis. Hardware Models: Internal representation of the input algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some aspects of Assignment problem, High – level Transformations. FPGA technologies: Physical Design cycle for FPGA's partitioning and routing for segmented and staggered models. MCM technologies, MCM physical design cycle, Partitioning, Placement – Chip array based and full custom approaches, Routing –Maze routing, Multiple stage routing, Topologic routing, Integrated Pin – Distribution and routing, routing and programmable MCM's.	simulation, Basic issues and Terminology, Binary-Decision diagram, Two Level Logic Synthesis:Internal representation of the input algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some aspects of Assignment problem, High-level Transformations:Physical Design cycle for FPGA's partitioning and routing for segmented and staggered models. MCM technologies, MCM physical design cycle, Partitioning, Placement-Chip array based and full custom approaches, Routing –Maze routing, Multiple stage routing, Topologic routing, Integrated Pin – Distribution and routing, routing and programmable MCM's.				
23VL5203	LOW POWER VLSI SYSTEM DESIGN	Skill Development	Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Device & Technology Impact on Low Power: Dynamic dissipation in CMOS,	Module 1 Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Device & Tech-nology Impact on Low Power: Dynamic dissipation	**Modified LTPS - 3100 to 3020**	**Adding the CO5**	**Practical activities challenge students to apply their knowledge to solve real-world problems, thereby honing their critical thinking**	**25**

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			Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation. Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy. Low Power Circuit's: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic. Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with	in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & De- vice innovation. Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. Module 2 Probabilistic power analysis: Random logic signals, probability & fre - quency, probabilistic power analysis techniques, signal entropy. Low Power Circuit's: Transistor and gate sizing, network restructuring and Reorganiza - tion. Special Flip Flops & L atches design, high capacitance nodes, low power digital cells library. Module 3 Logic level: Gate reorganization, signal gating, logic encoding, state ma- chine encoding, pre- computation logic. Low power Architecture & Systems: Power & performance management, switching activity reduction,			**and problem-solving abilities, which are essential for their professional growth.**	

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			voltage reduction, flow graph transformation, low power arithmetic components. Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network. Special Techniques: Power Reduction in Clock networks, CMOS Floating Node, Low Power Bus Delay balancing, and Low Power Techniques for SRAM.	parallel archi - tecture with voltage reduction, flow graph transformation, low power arithmetic components. Module 4 Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & packag e co design of clock network. Special Techniques: Power Reduction in Clock net- works, CMOS Floating Node, Low Power Bus Delay balancing, and Low Power Techniques for SRAM.				
23VL5401	TESTING OF VLSI CIRCUITS	Skill Development	CO1-Basics of Testing: Role of testing VLSI circuits, VLSI trends affecting testing, Test process and ATE, Fault Modeling: Functional Testing, Structural Testing, Types of Fault Models, Stuck-at Faults, Bridging Faults, cross point faults, Fault detection, Fault location, Fault Equivalence, Fault Dominance, Modeling Levels and Types of Simulators, True value simulation algorithm-Compiled-Code, Event-Driven; Fault Simulation Algorithm-Serial, Parallel,	CO1-Basics of Testing: Role of testing VLSI circuits, VLSI trends affecting testing, Test process and ATE, Fault Modeling: Functional Testing, Structural Testing, Types of Fault Models, Stuck-at Faults, Bridging Faults, cross point faults, Fault detection, Fault location, Fault Equivalence, Fault Dominance, Modeling Levels and Types of Simulators, True value simulation algorithm-Compiled-Code, Event-Driven; Fault Simulation Algorithm-Serial, Parallel,	**Modified LTPS - 3120 to 3020**	**No updating in CO**	**Replacing tutorials with practical sessions fosters experiential learning, improving retention and understanding of concepts.**	**15**

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			Deductive and Concurrent Fault Simulation. CO2-Test Generation for Combinational and Sequential Circuits: Test generation algorithms-Fault Table -path sensitization-Kohavi-Boolean difference, Test Generation for Combinational and Sequential Circuits, Testability Measures-Test generation for combinational and sequential logic circuits, Testable combinational and sequential logic circuit design. CO3-Design for Testability: Ad-hoc design, Generic scan-based design, Classical scan-based design-System level DFT approaches, Memory test. Introduction to BIST concepts: Built-In Self-Test: Test pattern generation for BIST, Circular BIST, BIST Architectures. CO4-Self Test and Testable Algorithms: Testable Memory Design, Test algorithms, Test generation for Embedded RAMs. Fault Diagnosis Logic: Diagnosis by UUT reduction, Fault Diagnosis for Combinational Circuits, Self-checking design, System Level Diagnosis.	Deductive and Concurrent Fault Simulation. CO2: -Test Generation for Combinational and Sequential Circuits: Test generation algorithms-Fault Table -path sensitization-Kohavi-Boolean difference, Test Generation for Combinational and Sequential Circuits, Testability Measures-Test generation for combinational and sequential logic circuits, Testable combinational and sequential logic circuit design. CO3-Design for Testability: Ad-hoc design, Generic scan-based design, Classical scan-based design-System level DFT approaches, Memory test. Introduction to BIST concepts: Built-In Self-Test: Test pattern generation for BIST, Circular BIST, BIST Architectures. CO4-Self Test and Testable Algorithms: Testable Memory Design, Test algorithms, Test generation for Embedded RAMs. Fault Diagnosis Logic: Diagnosis by UUT reduction, Fault Diagnosis for Combinational Circuits, Self-checking design, System Level Diagnosis.				

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SWARM ROBOTICS CONTROL SYSTEMS

Course Code: 23RA5302 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits: 3**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply the principles and various Swam Robotics Control Systems for directions	PO1, PO3	3
CO2	Apply multi-agent systems, parallel, scalable, stable for different types of tasks	PO1, PO3, PO4	3
CO3	Apply conccpts of Swam Robotics Control Systems and Creating Advanced behavior module.	PO1, PO3	3
CO4	Apply the Cooperative algorithms, earlier progress of swarm robotics algorithms, for navigate and control swarm movements effectively	PO3, PO4	3

Syllabus:

Swarm and robotics, several aspects. Definition swarm robotics, Characteristics of nature swarms, nature swarm, special features of the swarm robotics, single robot and other multi-individual systems, nature swarm to swarm intelligence, Advantages of swarm robotics Scalable, Stable, Economical, Energy efficient, Different multi-agent systems: Tasks cover large area robot, Tasks dangerous to robot, scaling population and redundancy, Swarm robotics system in real life. Modelling swarm robotics, General model of swarm robotics, Information exchange module, Direct communication, Communication through environment- Sensing, Basic behaviour module. Swarm robotics. Sensor-based modelling, microscopic modelling, Macroscopic modelling, Modelling swarm intelligence algorithms, Cooperation schemes between robots, Architecture of swarm, Locating, Physical connections, Self-organization and self-assembly, Entity projects and simulations. Earlier progress of swarm robotics algorithms, Features of swarm robotics algorithm, Simple, Scalable, Decentralization, Local, Parallel, Fundamental tasks of swarm robotics, Formation, Potential field functions, Positioning and navigation, Navigation, Obstacle avoidance, Swarm robotics searching algorithms, inspired from swarm intelligence algorithms, Optimizing the parameters, Modelling the individual behaviours, Mixing and Inspired methods. Processes (MDP), stochastic dynamic programming (SDP).

Text Books:

1. Swarm Robotics: A Formal Approach Elhadi Shakshuki Springer 2019
2. Swarm Robotics: Synchronization and Control Alejandro Ribeiro and Pramod Varshney Wiley 2018

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3. Swarm Robotics: A Comprehensive Guide Sabine Hauert, Vito Trianni, and Elio Tuci CRC Press 2018

Reference Books:

1. Principles of Robot Motion: Theory, Algorithms, and Implementations Howie Choset, Kevin M. Lynch, et al.The MIT Press, 2005
2. Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies Dario Floreano and Claudio Mattiussi, The MIT Press, 2008
3. K. Thorup, T. Alerstam, M. Hake, N. Kjellén, Bird orientation: compensation for wind drift in migrating raptors is age dependent, Proc Biol Sci; 270 (Suppl. 1) (2003), pp. S8-S11
4. Research Advance in Swarm Robotics Ying TAN*, Zhong-yang Peking University, Beijing 100871,

MOOCS/Web Links:

https://onlinecourses.nptel.ac.in/noc21_me44
https://www.coursera.org/lecture/robotics-flight/control-of-multiple-robots-sLAoY

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HUMAN MACHINE INTERFACE & BRAIN MACHINE INTERFACE

Course Code: 23RA5401 **L-T-P-S: 3-0-2-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply Norman's model to HMI	PO1, PO2	3
CO2	Apply different GOMS models, Fitts Laws for improving the Human Machine Interaction	PO1, PO4	3
CO3	Apply the concepts of Brainwaves for Brain Machine Interface	PO1, PO2	3
CO4	Analyze different methodologies for HMI/BMI Applications	PO1, PO3	4
CO5	Analysis of EEG Signal with BCI application	PO6, PO7	4

Syllabus:

Module 1: Introduction, history and relation to Ergonomics and Human Factors Problems and challenges, Recurrent HMI Themes, Concept of usability - definition and elaboration, Human Machine Interface and software engineering, GUI design and aesthetics, Prototyping techniques, Guidelines in HMI: Norman's seven principles, Norman's model of interaction. Module 2: Fitts Laws, Hick-Hyman Laws, Norman's 7 Principles. Design rules Authority vs. generality Principles, introduction to different types of models, GOMS family of models, KLM and CMN-GOMS, Guidelines in HMI: Norman's seven principles, Norman's model of interaction, Heuristic evaluation, Contextual inquiry, Cognitive walkthrough. Module 3: Alpha, Beta, Theta, Gamma wave, Brain-Control Interface, ARMA Model. Introduction to Brain Control Interface Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI Brain signal acquisition, Experiment design and data analysis (with explanation of one-way ANOVA), ARMA Model. Module 4: Hierarchical Task Analysis, Dialog Design, Use of FSM, Task modelling and analysis through Hierarchical task analysis (HTA), Dialog Design using FSM (finite state machines), Cognitive architecture, Object Oriented Modelling of User Interface Design, Applications of HMI/BMIs: rover, robotic camera, environmental control. Module 5: Case studies of BCIs based on multi-neuronal activity, electrocorticography (ECoG), and electroencephalography (EEG) as well as BCI applications, pervasive computing, CSCW, virtual reality, tangible user interface, multimedia

Text Books:

1. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.
2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
3. B. Schneiderman; Designing the User Interface, Indian Reprint, Addison Wesley 2000.

4. Jonathan Wolpaw,Elizabeth Winter Wolpaw,'Brain Computer Interfaces: Principles and practice", Edition 1, Oxford University Press, USA, January 2012

Reference Books:

1. Human-Machine Interface: Concepts and Design Principles Sridharan Devarajan and S. Srinivasan 2nd Tata McGraw-Hill Education Book
2. Brain-Computer Interfaces: Principles and Practice Rajesh P. N. Rao 1st Oxford University Press

MOOCS/Web Links:

https://www.expertsnotes.com/2016/04/jntuk-r-10-4-2-cse-human-computer.html
https://nptel.ac.in/courses/106103115/4
http://www.eolss.net/sample-chapters/c18/e6-43-37-06.pdf
https://www.Tutorials.in/How_Does_Your_HMI_Design. Special Issue on Brain Control Interfaces, IEEE Transactions on Neural Systems and Rehabilitation Engineering, Vol 14, June 2006

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TRANSFORMATION TECHNIQUES, RANDOM VARIABLES & STOCHASTIC PROCESSES

Course Code: 23VL5001 **L-T-P-S: 2-2-0-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply Mathematical models of random phenomena and solve probabilistic problems.	PO1, PO2	3
CO2	Analyze different types of random variables and compute statistical parameters of the random variables.	PO1, PO2	4
CO3	Apply random processes in the time domain and model time varying linear systems.	PO1, PO2	3
CO4	Analyze random processes in frequency domains and model spectral characteristics of LTI systems.	PO1, PO2, PO4	4

Syllabus:

THE RANDOM VARIABLE AND MULTIPLE RANDOM VARIABLES: CO1: Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties. Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions. OPERATION ON ONE AND MULTIPLT RANDOM VARIABLE-EXPECTATIONS: CO2: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Nonmonotonic Transformations of Continuous Random Variable. OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables. RANDOM PROCESSES – TEMPORAL CHARACTERISTICS:CO3: The Random Process Concept, Classification of Processes, Deterministic and Non deterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict- Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random

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Processes, Poisson Random Process. RANDOM PROCESSES -SPECTRAL CHARACTERISTICS: CO4: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Auto correlation Function, The Cross-Power Density Spectrum, Properties. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Auto correlation Function of Response, Cross-Correlation Functions of Input and Output.

Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z.Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI,4th Edition, 2002.
3. Probability and Random Processes with Applications to Signal Processing, Henry Starkand John W.Woods, Pearson Education, 3rd Edition, 2001.

Reference Books:

1. Schaum's Outline of Probability, Random Variables, and Random Processes, 1997.
2. An Introduction to Random Signals and Communication Theory, B. P. Lathi, International Textbook, 1968.
3. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill,2015

MOOCS/Web Links:

https://www.udemy.com/course/random-variable-random-process-problem-solving-techniques/

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VLSI PHYSICAL DESIGN

Course Code: 23VL5302 **L-T-P-S: 2-0-2-0**
Pre-requisite: NIL **Credits: 3**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply optimization techniques to improve the quality of circuit partitioning.	PO1, PO2	3
CO2	Apply the algorithms in placement and the impact of placement on timing constraints in VLSI circuits.	PO2	3
CO3	Apply appropriate routing strategies based on the specific requirements of the design and Analyze the benefits of topological routing in minimizing signal delays and optimizing performance	PO2	3
CO4	Solve practical design problems using state-of-the-art optimization tools and methodologies.	PO2, PO7	3
CO5	Implement the algorithms for physical design of VLSI circuits.	PO1, PO2	3

Syllabus:

CO-1 Introduction: Layout and design rules, materials for VLSI fabrication, basic algorithmic concepts for physical design, physical design processes, and complexities. Partition: Kernigham-Lin's algorithm, Fiduccia Mattheyes algorithm, hMETIS algorithm, multilevel partition techniques. CO-2 Floor-Planning: Hierarchical design, wire length estimation, slicing and non-slicing floor plan, polar graph representation, operator concept, Stockmeyer algorithm for floor planning, mixed integer linear program. Placement: Design types: ASICs, SoC, microprocessor RLM; Placement Techniques: Simulated annealing, partition-based, analytical, and Hall's quadratic; Timing and congestion considerations. CO-3 Routing: Detailed, global, and specialized routing, channel order, channel Routing problems, constraint graphs, routing algorithms, Yoshimura and Kuh's method, zone scanning, and net merging, boundary terminal problem, minimum density spanning forest problem, topological routing, cluster graph representation. CO-4 Sequential Logic Optimization and Cell Binding: State-based optimization, state minimization, algorithms; Library binding and its algorithms, concurrent binding.

Text Books:

1. Sarrafzadeh, M. and Wong, C.K., "An Introduction to VLSI Physical Design", 4th Ed., McGraw-Hill.1996
2. Wolf, W., "Modern VLSI Design System on Silicon", 2nd Ed., Pearson Education.2000
3. Sait, S.M. and Youssef, H., "VLSI Physical Design Automation: Theory and Practice", World Scientific.1999

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4. Dreschler, R., "Evolutionary Algorithms for VLSI CAD", 3rd Ed., Springer 2002
5. Sherwani, N.A., "Algorithm for VLSI Physical Design Automation", 2nd Ed., Kluwer.1999
6. Lim, S.K., "Practical Problems in VLSI Physical Design Automation", Springer.

Reference Books:

1. Physical Design Automation of VLSI Systems" by Sung-Mo (Steve) Kang, Yusuf Leblebici, and Chul Woo Kim
2. VLSI Physical Design: From Graph Partitioning to Timing Closure" by Andrew B. Kahng, Jens Lienig, Igor L. Markov, and Jin Hu
3. Introduction to VLSI Circuits and Systems" by John P. Uyemura

MOOCS/Web Links:

https://onlinecourses.nptel.ac.in/noc24_ee77

https://chipedge.com/vlsi-physical-design-course

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NANO ELECTRONICS

Course Code: 23VL5503 **L-T-P-S: 3-0-0-0**
Pre-requisite: NIL **Credits: 3**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand nanoelectronics and shrink-down approach	PO1	2
CO2	Interpret the concept behind nano MOSFET and nanodevices	PO1	3
CO3	Apply and Analyze the Schrodinger equation for different types of potentials in one dimension	PO1, PO2	3
CO4	Apply the process of nanofabrication and characterization facilities	PO1	3

Syllabus:

CO-1: Introduction: Recent past, the present and its challenges, Future, Overview of basic Nano electronics, Nano electronics & Nanocomputer architectures: Introduction to Nanocomputers, Nanocomputer Architecture, Quantum DOT cellular Automata (QCA), QCA circuits, Single electron circuits, molecular circuits, Logic switches – Interface engineering – Properties (Self-organization, Size-dependent) – Limitations. CO-2: Nanoelectronic Architectures: Nanofabrication – Nanopatterning of Metallic/Semiconducting nanostructures (e-beam/X-ray, Optical lithography, STM/AFM-SEM & Soft-lithography) – Nano phase materials – Self-assembled Inorganic/Organic layers. CO-3: Spintronics: Introduction, Overview, History & Background, Generation of Spin Polarization Theories of spin Injection, spin relaxation and spin dephasing, Spintronic devices and applications, spin filters, spin diodes, spin transistors. CO-4: Memory Devices And Sensors: Memory devices and sensors – Nano ferroelectrics – Ferroelectric random access memory –Fe-RAM circuit design–ferroelectric thin film properties and integration – calorimetric -sensors – electrochemical cells – surface and bulk acoustic devices – gas sensitive FETs – resistive semiconductor gas sensors – electronic noses – identification of hazardous solvents and gases – semiconductor sensor array.

Text Books:

1. K. Goser, P. Glosekotter & J. Dienstuhl, "Nanoelectronic and Nanosystems–From Transistors to Molecular Quantum Devices", Springer, (2004).

Reference Books:

1. Rainer Waser, "Nanoelectronics and Information Technology: Advanced Electronic Materials Novel and Devices", Wiley VCH, (2005).
2. George W. Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, (2008).

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3. Mick Wilson, Kamali Kannangara, Geoff smith, "Nanotechnology: Basic Science and Emerging Technologies", Overseas press, (2005).
4. W.R. Fahrner, "Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques", Springer, (2010). Branda Paz, "A Handbook on Nanoelectronics", Vedams books, (2008).

MOOCS/Web Links:

https://nptel.ac.in/courses/117108047

https://nptel.ac.in/courses/117108047/

https://www.coursera.org/lecture/nanotechnology1/characterizationtoolsfor-nanotechnology-Dx5rv -> AFM, SEM, TEM

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LINEAR ALGEBRA & CALCULUS FOR ENGINEERS

Course Code: 23MT1001 **L-T-P-S: 2-2-0-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply matrix algebra concepts to solve system of linear equations.	PO1	3
CO2	Apply multivariate differential calculus to find extremum of functions and solve differential equations.	PO1	3
CO3	Solve improper integrals using beta and gamma functions and also evaluate double and triple integrals.	PO1	3
CO4	Evaluate line, surface and volume integrals by vector calculus concepts.	PO1	3

Syllabus:

CO-1:Introduction to Matrix theory: Row echelon form and rank of a matrix, Systems of linear equations, Solution by Gauss elimination, LU-Decomposition, Eigen values and eigen vectors. Diagonalization of matrices, quadratic forms and their canonical forms. CO-2: Multivariate Differential calculus: Partial derivatives, Jacobian, total differentiation and their applications, chain rule, Taylor's series for function of two variables, maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers. Differential Equations: Mathematical models used in differential equations. Second and higher-order differential equations, along with the methods of solutions and their applications. CO-3: Multivariate Integral Calculus: Improper integrals, Beta, Gamma functions and their relationship. Line integrals - length of the arc, double and triple integrals and applications to area, volume, mass & moment of inertia. Change of order of integration, change of variables in polar, cylindrical and spherical polar coordinates. CO-4:VectorCalculus: Scalar and vector point functions, Gradient, Directional Derivative, Divergence and Curl, Evaluation of line integrals , Introduction to Greens and Stoke's theorems and their applications.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Willey & Sons, 10th edition, 2010, New Delhi, India.

Reference Books:

1. Higher Engineering Mathematics, By Dr. B.S. Grewal. Publisher: Khanna, New Delhi.

MOOCS/Web Links:

https://nptel.ac.in/courses/111105122

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https://nptel.ac.in/courses/111104137
https://nptel.ac.in/courses/111106051
http://www.math.utah.edu/~gustafso/2250forcedOscillations.pdf
http://ibgwww.colorado.edu/~carey/p7291dir/handouts/matrix.algebra.pdf
https://en.wikipedia.org/wiki/LU_decomposition

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DISCRETE STRUCTURES

Course Code: 23MT1002 **L-T-P-S: 2-2-0-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply the concepts of sets, relations, and function to computer-oriented problems	PO1	3
CO2	Apply logic and inference theory to test the validity of the arguments	PO1	3
CO3	Apply the counting technique principles to predict the data and solve the Recurrence of Relations	PO1	3
CO4	Apply graph theory concepts to solve the network problems in suitable algorithms	PO1	3

Syllabus:

CO-1: Basic Discrete Structures: Sets: Sets and Subsets, Power Set, Cartesian Product, Set Operations, Venn Diagram, Inclusion-Exclusion Principle, Computer Representation of Sets. Functions: Basic Concept, Injective and Bijective Functions, Inverse and Composite Functions, Graph of Functions, Functions for Computer Science (Ceiling Function, Floor Function, Boolean Function, Exponential Function) Posets: Relations and their Properties, n-array relations and their applications, representing relations, Closure of relations, equivalence of relations, partial orderings. CO-2: Logic and Proof Methods. Logic: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Negation of Quantified Statements, Proof of quantified statements, Nested Quantifiers, Rules of Inferences, proof methods: Basic Terminologies, Proof Methods (Direct Proof, Indirect Proof, Proof by Contradiction, Proof By Contraposition). CO-3:Counting The basics of counting, the pigeonhole principle, permutations and combinations, recurrence relations, solving Linear recurrence relations with constant coefficients, Divide-and-Conquer algorithm and Recurrence Relation, Particular solution, total solution, Generating functions, Inclusion and Exclusion, Application of Inclusion and exclusion function. CO-4:Graph Theory Introduction of Graphs, Graphs and Graph Models, Graph terminology and special types of graphs, representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamiltonian Path, Shortest path Problems, Planar graphs, Graph Coloring. Trees: Introduction and Applications, Spanning Trees, Minimum Spanning Trees (Kruskal's Algorithm).

Text Books:

1. Kenneth H. Rosen, Discrete mathematics and its applications, McGraw Hill Publication, 2022.
2. Bernard Kolman, Robert Busby, Sharon C. Ross, Discrete Mathematical Structures, Sixth Edition Pearson Publications, 2015

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Reference Books:

1. Joe L Mott, Abraham Kandel, Theodore P Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Printice Hall of India, Second Edition, 2008.
2. Tremblay J P and Manohar R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill publishers, 1st edition, 2001,India.

MOOCS/Web Links:

Computer Science and Engineering - NOC: Discrete Structures NPTEL :: Computer Science and Engineering -- Discrete Mathematical Structures https://www.coursera.org/specializations/discrete-mathematics https://onlinecourses.nptel.ac.in/noc23_cs109/preview

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OPTIMIZATION IN ENGINEERING

Course Code: 23MT2006 **L-T-P-S: 2-2-0-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply Mathematical models of optimization and solve learning problems.	PO1,PO2	3
CO2	Analyze different types of optimization techniques and	PO1,PO2	3
CO3	compute parameters of the objective function. Apply standard optimization models in finding optimal solutions in engineering	PO1,PO2	3
CO4	Analyze optimization models in machine learning and model. their role in learning systems.	PO1,PO2	3

Syllabus:

Objective Functions and Decision Variables: Definition, purpose, mathematical representations, metrics, types of optimizations, linear, nonlinear, convex, concave, multi-objective optimization, trade-offs between conflicting objectives. Types of Decision Variables, Physical Interpretation, Constraints on Decision Variables, Dimensionality and Parameterization. Constraints and Feasibility: Types of Constraints, Physical Interpretation, Feasibility Testing, Feasibility vs. Optimality, bounded region, an unbounded region, a convex region, a non-convex region, Optimal Solution within the Feasible Region. Optimal Solution: Definition, Gradient and Hessian, Types of Optimal Solutions, Optimization Algorithms: gradient descent, Newton\'s method, genetic algorithms, simulated annealing, characteristics of the optimization problem, including its dimensionality, convexity, smoothness. Optimization in engineering examples: Structural Engineering, Mechanical Engineering, improve efficiency, reduce manufacturing costs, or meet performance specifications, Power Systems Optimization, Multi-body Dynamics Optimization.

Text Books:

1. Rao S. S.-'Engineering Optimization, Theory and Practice' - New Age International Publishers - 2012 - 4th Edition
2. Optimization for Machine Learning, by Sra Suvrit, Nowozin Sebastian, Wright Stephen J. PHI Learning Private Limited (1 January 2013).

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, by Charu C. Aggarwal, Springer; 1st ed. 2020 edition (13 May 2020)

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RANDOM VARIABLES AND STOCHASTIC PROCESS

Course Code: 23MT2007 **L-T-P-S: 2-2-0-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply Mathematical models of random phenomena and solve probabilistic problems.	PO1, PO2	3
CO2	Analyze different types of random variables and compute statistical parameters of the random variables.	PO1, PO2	4
CO3	Apply random processes in the time domain and model time varying linear systems.	PO1, PO2	3
CO4	Analyze random processes in frequency domains and model spectral characteristics of LTI systems.	PSO1, PO1, PO2, PO4	4

Syllabus:

CO1: THE RANDOM VARIABLE AND MULTIPLE RANDOM VARIABLES: Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties. Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions. CO2: OPERATION ON ONE AND MULTIPLE RANDOM VARIABLE-EXPECTATIONS: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Nonmonotonic Transformations of Continuous Random Variable. OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables. CO3: RANDOM PROCESSES –TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Non-deterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-order stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict- Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. CO4: RANDOM PROCESSES -SPECTRAL

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CHARACTERISTICS: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties. Random Signal Response of Linear Systems: System Response, Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z.Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI,4th Edition, 2002.
3. Probability and Random Processes with Applications to Signal Processing, Henry Starkand John W.Woods, Pearson Education, 3rd Edition, 2001.

Reference Books:

1. Schaum's Outline of Probability, Random Variables, and Random Processes, 1997.
2. An Introduction to Random Signals and Communication Theory, B.P.Lathi, International Textbook, 1968.
3. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill,2015.

MOOCS/Web Links:

https://archive.nptel.ac.in/courses/117/105/117105085/

https://www.udemy.com/course/random-variable-random-process-problem-solving-techniques/

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FUNDAMENTALS OF IOT AND SENSORS

Course Code: 23EC1101 **L-T-P-S: 3-0-4-0**
Pre-requisite: NIL **Credits: 5**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Able to demonstrate their understanding and apply the basic concepts of IoT by utilizing the Development Hardware for implementation.	PO1,PO2,PSO1	3
CO2	Able to demonstrate their comprehension and apply knowledge about various sensors interfacing with Development Hardware.	PSO1,PO2,PO3	3
CO3	Able to understand and apply the concepts on different systems to interface various actuators with Development Hardware.	PO3,PO2,PSO1	3
CO4	Able to apply and analyze the IoT concept to solve real time insights	PSO1,PO2,PO3,PO4	4
CO5	Able to apply and analyze the concept of IoT by interfacing with sensors and Development Hardware	PSO1,PO2,PO3,PO5	4

Syllabus:

CO-1: Introduction to Fundamentals of IoT Introduction, Characteristics, Architecture, Applications, Development Hardware. Multiplexer (74LS153), De-multiplexer (74155), Encoder (SN74LS148), Decoder (74LS138), Microcontroller (ATMEGA328P). Arduino: Introduction, Types, Features, Pin Description, IDE - Applications, Arduino GPIO Programming CO-2: Sensors and its Interfacing Introduction of Sensors: Definition, Types, Classification, Temperature Sensors: Thermistor, Thermistor types. Sensors Interfacing and implementation for various applications: LM35 Interfacing, Light Dependent Resistor Interfacing, Infra-Red Sensor Interfacing, PIR Sensor Interfacing, Ultrasonic Sensor Interfacing, Gas Sensor Interfacing. CO-3: Actuators and its interfacing Introduction of actuator: Introduction, Types, Actuators Interfacing and implementation for various applications: DC Motor, Servo Motor, Stepper Motor, Motor Driver circuit, Relay, optocouplers. CO-4: ESP32: Introduction, Features, Pin Description, GPIO Programming Displays and its interfacing: 7 Segment and its types, LCD pin description, commands. IoT Case Studies: Home Automation, Smart Irrigation, Smart Health care. (*Self-Learning Topics: Smart Lighting, Intrusion Detection, Smoke Detectors, Smart Parking, Air Pollution)

Text Books:

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1. Internet of Things By Rajkamal, Tata McGraw Hill publication. 2. Internet of things (A-Hand-on-Approach) By Vijay Madisetti and Arshdeep Bahga 1st Edition, Universal Press.

Reference Books:

1. The Internet of Things: Connecting Objects By Hakima Chaouchi Wiley publication 2. The Internet of Things Key applications and Protocols By Olivier Hersent, David Boswarthick, Omar Elloumi,, Wiley, 2012

MOOCS/Web Links:

https://www.arm.com/resources/education/online-courses/internet-of-things

https://online.stanford.edu/courses/xee100-introduction-internet-things

https://archive.nptel.ac.in/courses/106/105/106105166/#

https://www.cdbb.cam.ac.uk/subject/internet-things-iot

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BASIC ELECTRICAL AND ELECTRONIC CIRCUITS

Course Code: 23EC1203 **L-T-P-S: 2-0-0-0**
Pre-requisite: NIL **Credits: 2**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the basic concepts of circuits and its fundamentals	PSO1, PO1	2
CO2	Grasp the principles of AC circuits, including sinusoidal wave forms, impedance, and power factor.	PSO1, PO1	2
CO3	Comprehend the behavior of basic electronic components, such as diodes, transistors.	PSO1, PO1	2
CO4	Understand the basic functional Principles of analog and digital ICs.	PSO1, PO1	2

Syllabus:

Basic circuit elements, Circuit fundamental: Mesh analysis and Nodal analysis, Thevenin's theorem, Norton's theorem, Super position theorem, Maximum power transfer theorem AC fundamentals: RMS value, Average Values, Form & Peak factor, Steady state analysis (R, L, C, etc), Reactance, Impedance, Phase & Phase difference, Real power, Reactive power, Power factor Operation of the diode, Diode as switch, Rectifiers, Clipper, Clampers, Zener Diode as a regulator, Operation of Transistor, Transistor as switch Analog & Digital ICs: Voltage regulators 7805, 7905, and LM723, Operational Amplifiers IC 741, Timer IC 555, Comparators LM 339

Text Books:

1. Electrical Circuit Theory and Technology, John Bird ed6 Routledge publishers Pearson/PHI
2. Electronic Devices and Circuit Theory Robert L. Boylestad 12ed,Mc Graw Hill
3. Circuits and Networks: Analysis and Synthesis A Sudhakar, Shyam Mohan S PalII, ed, TMH
4. Electronic Devices and Circuits David A. Bell, 5ed, PHI

Reference Books:

1. ELECTRONIC DEVICES AND CIRCUITS, BY K.LAL KISHORE, BS PUBLICATIONS
2. ELECTRONIC DEVICES AND CIRCUITS BY GSN RAJU, IK INTERNATIONAL,
3. OP-AMPS and linear integrated circuit technology by RAMAKANTH A GAYAKWAD, 4 EDITION PEARSON, PHI.

MOOCS/Web Links:

https://youtu.be/7Nh7ISeqn6E

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https://ocw.mit.edu/courses/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/9b3b5a9eef65ffb51e8288887a79c2ef_17_diodes1.pdf

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LEADERSHIP AND MANAGEMENT SKILLS

Course Code: 23UC0027 **L-T-P-S: 0-0-4-0**
Pre-requisite: NIL **Credits: 2**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand basic leadership, skills and perspectives and leadership styles	PO1, PO2	2
CO2	Understand different managerial skills and apply them to develop high performance teams	PO1, PO2	2
CO3	Analyse effective communicative strategies and apply them in team tasks	PO1, PO2	3
CO4	Apply strategic planning fundamentals and decision-making techniques, through exercises and case studies	PO1, PO2	3

Syllabus:

CO 1: Fundamentals of Leadership Skills Understanding Leadership and its Importance, Traits and Models/styles of Leadership, Perspectives on Leadership: Bipolarity-Unidimensionality - Bidimensionality-Hierarchical: Management within Leadership - Hierarchical: Leadership within Management, Basic Leadership Skills: Motivation, Teamwork, Negotiation & Networking, Emotional intelligence. CO-2: Managerial Skills - Basic Managerial Skills - Planning for effective management, Recruiting and Retaining Talent - Delegation of tasks - Learn to Coordinate, Organising, Building and Leading high-performance Teams. CO-3: Effective Communication Strategies for Leaders and Managers - Self-Management Skills: Understanding Self-Concept - Developing Self-Awareness -Self-Examination - Self-Regulation, Active Listening and Feedback Techniques, Conflict Management & Conflict Resolution - Negotiation skills, Role-playing and Group activities CO-4: Strategic Planning and Decision-Making - Fundamentals of Strategic Planning and Decision-Making - Setting Goals & Objectives for the Organization, Strategic Tools: SWOT, PEST, FORCE FIELD, SCENARIO PLANNING and SIX THINKING HATS, etc., Simulation Exercises and Strategic Planning Case Studies.

Text Books:

1. , The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership Caruso, D. R. and Salovey P First edition, 2004 JohnWiley & Sons

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2. Training in Interpersonal Skills:Tips for Managing People at work Stephen P. Robbins, Phillip L. Hunsaker 6 edition, 2015Pearson Education

Reference Books:

3. Learning to Lead: A Workbook on Becoming a LeaderBennis, W.and Goldsmith, J
4. 4th edition, 2010Reading, Mass. : Addison-Wesley

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DIGITAL DESIGN AND COMPUTER ARCHITECTURE

Course Code: 23EC1202 **L-T-P-S: 3-0-2-0**
Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Build the combinational and programmable digital logic circuits using logic gates and optimization methods	PSO1, PO1, PO2	3
CO2	Construct the sequential and memory circuits using flip-flops	PSO1, PO1, PO2	3
CO3	Able to organize computer architecture and instructions sequence	PSO1, PO1, PO2	3
CO4	Model the Memory Architecture and I/O Organization modules	PSO1, PO1, PO2	3
CO5	Develop and analyze of computer architecture modules using basic combinational, sequential and memory logics	PSO1, PO1, PO3, PO5	4

Syllabus:

CO 1: Combinational Digital Logic Circuits: Boolean Algebra, Digital Logic SOP/POS representation and optimization techniques. Adders, Subtractors, Multiplexers, De-Multiplexers, Decoder, Encoder, Concept of Reversible Gates. Programmable Logic Devices: PROM, PAL, and PLA design. Implementation of CPLD (Macrocells) and FPGA (CLB/LUT) based digital logic modules and their applications. CO-2: Design of Sequential and Memory Circuits: Latches and Flip-Flops, Modeling of memory ,registers and Shift registers, Timing and sequence control modules using Asynchronous/Synchronous counters, Ring and Johnson counter as timing and control units. Random Access Memory (RAM) and Memory decoding. CO-3: Basic Computer Architecture and Instructions: Features of Micro Computer, Operands, Addressing modes, Instruction formats, Machine cycle, Instruction sets, subroutine call and return mechanisms. Instruction set architectures - CISC and RISC architectures. Hardwired realization vs micro-programmed realization, multi-cycle implementation, Instruction level parallelism, instruction pipelining and pipeline hazards. CO-4: Memory Architecture and I/O Organization Storage systems, introduction to memory hierarchy: importance of temporal and spatial locality; main memory organization, cache memory: address mapping, block size, replacement, and store policies. Virtual Memory System: page table and TLB. External storage; IO fundamentals: handshaking, buffering, programmed IO, interrupt driven IO.

Text Books:

1. Computer System Architecture by M. Moris Mano, 3rd edition published by Pearson/PHI

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2. Fundamentals of Digital Logic with Verilog HDL by Stephen Brown and Zvonko Vranesic, 3rd edition, Published by Mc Graw Hill

Reference Books:

1. Computer Organization and Design by DA Patterson and JL Hennessy, 4th edition published by Morgan Kaufmann Publisher
2. Computer Organization and Architecture, by W. Stalling published by PHI.

MOOCS/Web Links:

https://nptel.ac.in/courses/117106086

https://archive.nptel.ac.in/courses/106/105/106105163/

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GLOBAL LOGIC BUILDING CONTEST PRACTICUM

Course Code: 23UC0014 **L-T-P-S: 0-0-0-2**
Pre-requisite: NIL **Credits: 0**

COURSE OUTCOMES (COs):

CO#	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO5	Codechef Contest	PO1, PO3, PO8, PO9, PO12, PSO1, PSO2	5

Syllabus:

CodeChef Contest

Text Books:

1. CodeChef Contest

Reference Books:

1. CodeChef Contest

MOOCS/Web Links:

https://www.codechef.com/

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Annexure – IV

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Y23 ACADEMIC STRUCTURE & FLEXIBILITIES FOR BACHELOR OF TECHNOLOGY (ECE)

MAJOR FLEXIBILITY / PROGRAM ADD-ON

NO PROGRAM ADD-ON

NO MAJOR FLEXIBILITY

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	0	0	0	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	0	0	0	
21	SDC	SDP-1	2	2	1	1	
22	SDC	SDP-2	2	2	1	1	
23	SDC	SDP-3	2	2	1	1	
24	PEC	PE-1	5	5	1	1	
25	PEC	PE-2	3	3	1	1	
26	PEC	PE-3	5	5	1	1	
27	PEC	PE-4	3	3	1	1	
28	PRI	PRI-CORE	16	16	4	4	
29	OEC	OE-1	4	4	1	1	
30	OEC	OE-2	4	4	1	1	
31	OEC	OE-3	4	4	1	1	
32	VAC	VAC-SPORTS	0	0	1	1	
33	VAC	VAC-CERT	0	0	3	3	
34	AUC	AUC-CORE	0	0	5	6	
35	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			166	166	58	59	166

Major Flexibility - HONORS

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	8	16	2	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	PEC	PE-1	5	5	1	1	
25	PEC	PE-2	3	3	1	1	
26	PEC	PE-3	5	5	1	1	
27	PEC	PE-4	3	3	1	1	
28	PRI	PRI-CORE	16	16	4	4	
29	OEC	OE-1	4	4	1	1	
30	OEC	OE-2	4	4	1	1	
31	OEC	OE-3	4	4	1	1	
32	VAC	VAC-SPORTS	0	0	1	1	
33	VAC	VAC-CERT	0	0	4	4	
34	AUC	AUC-CORE	0	0	5	6	
35	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			174	220	61	68	186

Major Flexibility - HONORS through RESEARCH

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	9	12	3	4	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	PEC	PE-1	5	5	1	1	
25	PEC	PE-2	3	3	1	1	
26	PEC	PE-3	5	5	1	1	
27	PEC	PE-4	3	3	1	1	
28	PRI	PRI-CORE	20	20	4	4	RESEARCH
29	OEC	OE-1	4	4	1	1	
30	OEC	OE-2	4	4	1	1	
31	OEC	OE-3	4	4	1	1	
32	VAC	VAC-SPORTS	0	0	1	1	
33	VAC	VAC-CERT	0	0	3	3	
34	AUC	AUC-CORE	0	0	5	6	
35	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			179	236	61	71	186

Major Flexibility - HONORS through INNOVATION

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	8	16	2	4	
20	HEC	HEC-CORE	0	16	0	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	PEC	PE-1	5	5	1	1	
25	PEC	PE-2	3	3	1	1	
26	PEC	PE-3	5	5	1	1	
27	PEC	PE-4	3	3	1	1	
28	PRI	PRI-CORE	20	20	4	4	INNOVATION
29	OEC	OE-1	4	4	1	1	
30	OEC	OE-2	4	4	1	1	
31	OEC	OE-3	4	4	1	1	
32	VAC	VAC-SPORTS	0	0	1	1	
33	VAC	VAC-CERT	0	0	3	3	
34	AUC	AUC-CORE	0	0	5	6	
35	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			178	224	60	71	186

Major Flexibility - HONORS through EXPERIENTIAL LEARNING

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	8	16	2	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	PEC	PE-1	5	5	1	1	
25	PEC	PE-2	3	3	1	1	
26	PEC	PE-3	5	5	1	1	
27	PEC	PE-4	3	3	1	1	
28	PRI	PRI-CORE	20	20	4	4	CAPSTONE
29	OEC	OE-1	4	4	1	1	
30	OEC	OE-2	4	4	1	1	
31	OEC	OE-3	4	4	1	1	
32	VAC	VAC-SPORTS	0	0	1	1	
33	VAC	VAC-CERT	0	0	4	4	
34	AUC	AUC-CORE	0	0	5	6	
35	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			178	224	61	68	186

Program Add-On SPECIALIZATION

NO MAJOR FLEXIBILITY

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	0	0	0	0	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	4	4	1	1	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	0	0	0	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	0	0	0	
21	SDC	SDP-1	2	2	1	1	
22	SDC	SDP-2	2	2	1	1	
23	SDC	SDP-3	2	2	1	1	
24	SDC	SDP-4	2	2	1	1	SPECIALIZATION
25	PEC	PE-1	5	5	1	1	SPECIALIZATION
26	PEC	PE-2	3	3	1	1	SPECIALIZATION
27	PEC	PE-3	5	5	1	1	SPECIALIZATION
28	PEC	PE-4	3	3	1	1	SPECIALIZATION
29	PEC	PE-5	3	3	1	1	SPECIALIZATION
30	PRI	PRI-CORE	16	16	4	4	
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			171	171	60	61	171

Major Flexibility - HONORS

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	8	16	2	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	SDC	SDP-4	4	4	1	1	SPECIALIZATION
25	PEC	PE-1	7	7	1	1	SPECIALIZATION
26	PEC	PE-2	3	3	1	1	SPECIALIZATION
27	PEC	PE-3	7	7	1	1	SPECIALIZATION
28	PEC	PE-4	3	3	1	1	SPECIALIZATION
29	PEC	PE-5	3	3	1	1	SPECIALIZATION
30	PRI	PRI-CORE	16	16	4	4	
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	4	4	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			185	231	63	70	196

Major Flexibility - HONORS through RESEARCH

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	9	12	3	4	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	SDC	SDP-4	4	4	1	1	SPECIALIZATION
25	PEC	PE-1	7	7	1	1	SPECIALIZATION
26	PEC	PE-2	3	3	1	1	SPECIALIZATION
27	PEC	PE-3	7	7	1	1	SPECIALIZATION
28	PEC	PE-4	3	3	1	1	SPECIALIZATION
29	PEC	PE-5	3	3	1	1	SPECIALIZATION
30	PRI	PRI-CORE	20	20	4	4	RESEARCH
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			190	247	63	73	196

Major Flexibility - HONORS through INNOVATION

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	8	16	2	4	
20	HEC	HEC-CORE	0	16	0	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	SDC	SDP-4	4	4	1	1	SPECIALIZATION
25	PEC	PE-1	7	7	1	1	SPECIALIZATION
26	PEC	PE-2	3	3	1	1	SPECIALIZATION
27	PEC	PE-3	7	7	1	1	SPECIALIZATION
28	PEC	PE-4	3	3	1	1	SPECIALIZATION
29	PEC	PE-5	3	3	1	1	SPECIALIZATION
30	PRI	PRI-CORE	20	20	4	4	INNOVATION
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			189	251	62	73	196

Major Flexibility - HONORS through EXPERIENTIAL LEARNING

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	8	16	2	4	
21	SDC	SDP-1	2	4	1	1	
22	SDC	SDP-2	2	4	1	1	
23	SDC	SDP-3	2	4	1	1	
24	SDC	SDP-4	4	4	1	1	SPECIALIZATION
25	PEC	PE-1	7	7	1	1	SPECIALIZATION
26	PEC	PE-2	3	3	1	1	SPECIALIZATION
27	PEC	PE-3	7	7	1	1	SPECIALIZATION
28	PEC	PE-4	3	3	1	1	SPECIALIZATION
29	PEC	PE-5	3	3	1	1	SPECIALIZATION
30	PRI	PRI-CORE	20	20	4	4	CAPSTONE
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	4	4	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			189	235	63	70	196

Program Add-On MINOR

NO MAJOR FLEXIBILITY

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
Sl No	Course						Min. Credits
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	0	0	0	0	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	4	4	1	1	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	0	0	0	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	0	0	0	
21	MIN	MIN-CORE	16	16	4	4	MINOR
22	SDC	SDP-1	2	2	1	1	
23	SDC	SDP-2	2	2	1	1	
24	SDC	SDP-3	2	2	1	1	
25	MSDC	MIN-SDP	4	4	1	1	MINOR
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
30	PRI	PRI-CORE	16	16	4	4	
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			186	186	63	64	186

Major Flexibility - HONORS

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
Sl No	Course						Min. Credits
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	0	0	0	0	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	4	4	1	1	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	8	16	2	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	MIN	MIN-CORE	16	16	4	4	MINOR
22	SDC	SDP-1	2	4	1	1	
23	SDC	SDP-2	2	4	1	1	
24	SDC	SDP-3	2	4	1	1	
25	MSDC	MIN-SDP	4	4	1	1	MINOR
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
30	PRI	PRI-CORE	16	16	4	4	
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	4	4	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			194	240	66	73	206

Major Flexibility - HONORS through RESEARCH

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
Sl No	Course						Min. Credits
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	9	12	3	4	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	MIN	MIN-CORE	16	16	4	4	MINOR
22	SDC	SDP-1	2	4	1	1	
23	SDC	SDP-2	2	4	1	1	
24	SDC	SDP-3	2	4	1	1	
25	MSDC	MIN-SDP	4	4	1	1	MINOR
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
30	PRI	PRI-CORE	20	20	4	4	RESEARCH
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			199	256	66	76	206

Major Flexibility - HONORS through INNOVATION

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
Sl No	Course						Min. Credits
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	8	16	2	4	
20	HEC	HEC-CORE	0	16	0	4	
21	MIN	MIN-CORE	16	16	4	4	MINOR
22	SDC	SDP-1	2	4	1	1	
23	SDC	SDP-2	2	4	1	1	
24	SDC	SDP-3	2	4	1	1	
25	MSDC	MIN-SDP	4	4	1	1	MINOR
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
30	PRI	PRI-CORE	20	20	4	4	INNOVATION
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			198	244	65	76	206

Major Flexibility - HONORS through EXPERIENTIAL LEARNING

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
Sl No	Course						Min. Credits
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	8	16	2	4	
21	MIN	MIN-CORE	16	16	4	4	MINOR
22	SDC	SDP-1	2	4	1	1	
23	SDC	SDP-2	2	4	1	1	
24	SDC	SDP-3	2	4	1	1	
25	MSDC	MIN-SDP	4	4	1	1	MINOR
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
30	PRI	PRI-CORE	20	20	4	4	CAPSTONE
31	OEC	OE-1	4	4	1	1	
32	OEC	OE-2	4	4	1	1	
33	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	4	4	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			198	244	66	73	206

Program Add-On DOUBLE MAJOR

NO MAJOR FLEXIBILITY

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	0	0	0	0	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	4	4	1	1	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	0	0	0	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	0	0	0	
21	SMFC	SMFC-CORE	21	21	5	5	DOUBLE MAJOR
22	SMFC	SMFC-SDP	4	4	1	1	DOUBLE MAJOR
23	SDC	SDP-1	2	2	1	1	
24	SDC	SDP-2	2	2	1	1	
25	SDC	SDP-3	2	2	1	1	
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
33	PRI	PRI-CORE	16	16	4	4	
30	OEC	OE-1	4	4	1	1	
31	OEC	OE-2	4	4	1	1	
32	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			191	191	64	65	191

Major Flexibility - HONORS

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	0	0	0	0	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	4	4	1	1	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	8	16	2	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	SMFC	SMFC-CORE	21	21	5	5	DOUBLE MAJOR
22	SMFC	SMFC-SDP	4	4	1	1	DOUBLE MAJOR
23	SDC	SDP-1	2	4	1	1	
24	SDC	SDP-2	2	4	1	1	
25	SDC	SDP-3	2	4	1	1	
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
33	PRI	PRI-CORE	16	16	4	4	
30	OEC	OE-1	4	4	1	1	
31	OEC	OE-2	4	4	1	1	
32	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	4	4	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			199	245	67	74	211

Major Flexibility - HONORS through RESEARCH

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	9	12	3	4	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	0	16	0	4	
21	SMFC	SMFC-CORE	21	21	5	5	DOUBLE MAJOR
22	SMFC	SMFC-SDP	4	4	1	1	DOUBLE MAJOR
23	SDC	SDP-1	2	4	1	1	
24	SDC	SDP-2	2	4	1	1	
25	SDC	SDP-3	2	4	1	1	
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
33	PRI	PRI-CORE	20	20	4	4	RESEARCH
30	OEC	OE-1	4	4	1	1	
31	OEC	OE-2	4	4	1	1	
32	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			204	261	67	77	211

Major Flexibility - HONORS through INNOVATION

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	32	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	8	16	2	4	
20	HEC	HEC-CORE	0	16	0	4	
21	SMFC	SMFC-CORE	21	21	5	5	DOUBLE MAJOR
22	SMFC	SMFC-SDP	4	4	1	1	DOUBLE MAJOR
23	SDC	SDP-1	2	4	1	1	
24	SDC	SDP-2	2	4	1	1	
25	SDC	SDP-3	2	4	1	1	
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
33	PRI	PRI-CORE	20	20	4	4	INNOVATION
30	OEC	OE-1	4	4	1	1	
31	OEC	OE-2	4	4	1	1	
32	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	3	3	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			203	249	66	77	211

Major Flexibility - HONORS through EXPERIENTIAL LEARNING

Sl No	Course Category	Sub-Category	Min. Credits	Max. Credits	Min Courses	Max Courses	Grouping
1	HAS	HAS-CORE	10	10	5	5	
2	HAS	HAS-FLE	3	3	1	1	
3	HAS	HAS-MNG	4	4	1	1	
4	BSC	BSC-CORE	4	4	1	1	
5	BSC	BSC-ME-1	4	4	1	1	
6	BSC	BSC-ME-2	4	4	1	1	
7	BSC	BSC-ME-3	4	4	1	1	
8	BSC	BSC-ME-4	0	0	0	0	
9	BSC	BSC-ME-5	0	0	0	0	
10	BSC	BSC-SE-1	4	4	1	1	
11	BSC	BSC-SE-2	4	4	1	1	
12	BSC	BSC-SE-3	0	0	0	0	
13	ESC	ESC-CORE	34	34	9	9	
14	PCC	PCC-CORE	32	48	8	8	
15	FCC	FC-1	3	3	1	1	
16	FCC	FC-2	3	3	1	1	
17	HFC	HFC-CORE	0	16	0	4	
18	HRC	HRC-CORE	0	0	0	0	
19	HIC	HIC-CORE	0	0	0	0	
20	HEC	HEC-CORE	8	16	2	4	
21	SMFC	SMFC-CORE	21	21	5	5	DOUBLE MAJOR
22	SMFC	SMFC-SDP	4	4	1	1	DOUBLE MAJOR
23	SDC	SDP-1	2	4	1	1	
24	SDC	SDP-2	2	4	1	1	
25	SDC	SDP-3	2	4	1	1	
26	PEC	PE-1	5	5	1	1	
27	PEC	PE-2	3	3	1	1	
28	PEC	PE-3	5	5	1	1	
29	PEC	PE-4	3	3	1	1	
33	PRI	PRI-CORE	20	20	4	4	CAPSTONE
30	OEC	OE-1	4	4	1	1	
31	OEC	OE-2	4	4	1	1	
32	OEC	OE-3	4	4	1	1	
34	VAC	VAC-SPORTS	0	0	1	1	
35	VAC	VAC-CERT	0	0	4	4	
36	AUC	AUC-CORE	0	0	5	6	
37	SIL	SIL-CORE	3	3	3	3	
CREDITS FOR GRADUATION			203	249	67	74	211

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Annexure-V

Modification and upgradation of courses under Y22 structure (B.Tech, ECE)

Courses	Old Structures				Proposed Structures				Delivery Mode
	L	T	P	S	L	T	P	S	
PE-1	3	0	0	0	2	0	2	4	R/P/A
PE-2	3	0	0	0	2	0	2	0	R
PE-3	3	0	0	0	2	0	2	4	R/P/A
PE-4	3	0	0	0	3	0	0	0	M/MA
PE-5	3	0	0	0	2	0	2	0	R

The following new courses are added

Sl.No.	Course Code	Course Name	Category	L	T	P	S	Cr	Ch	Pre-requisite
1	22UC0012	Innovation Management	HSS	2	0	0	0	0	2	Nil
2	UC0014	Activity Based Learning	HSS	0	0	4	0	0	4	Nil

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Annexure-VI

1. Modification and upgradation of courses under Y21 structure (B.Tech, ECE)

Courses	Old Structures				Proposed Structures				Delivery Mode
	L	T	P	S	L	T	P	S	
PE-1	3	0	0	0	2	0	2	4	R/P/A
PE-2	3	0	0	0	2	0	2	0	R
PE-3	3	0	0	0	2	0	2	4	R/P/A
PE-4	3	0	0	0	3	0	0	0	M/MA
PE-5	3	0	0	0	2	0	2	0	R

2. The following new courses are added

Sl.No.	Course Code	Course Name	Category	L	T	P	S	Cr	Ch	Pre-requisite
1	21UC0012	Innovation Management	HSS	2	0	0	0	0	2	Nil
2	UC0014	Activity Based Learning	HSS	0	0	4	0	0	4	Nil

3. The course "Deep Learning" is updated as "Deep Network Architectures"

Annexure-VII

Modification and upgradation of courses under Y20 structure (B.Tech, ECE)

The following new courses are added

Sl.No.	Course Code	Course Name	Category	L	T	P	S	Cr	Ch	Pre-requisite
1	20UC0012	Gender Sensitization	HSS	2	0	0	0	2	2	Nil
2	20IE3051	Industry Internship	PR	0	0	0	8	2	8	Nil

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Annexure-VIII

The following are the proposed pre-PhD courses for the Y23 admitted scholars

Paper 2		
Sl.No.	Course Code	Course Name
1	23EC201	Global Positioning Systems
2	23EC202	Machine Learning
3	23EC203	Embedded Networking
4	23EC204	Modern Digital Communication
5	23EC205	Soft Computing
6	23EC206	Digital Video Processing
7	23EC207	Radiating systems
8	23EC208	Micro Electro Mechanical Systems
9	23EC209	RF & Microwave System Design
10	23EC210	Low Power VLSI Circuits
11	23EC211	Detection and Estimation Of Signals
12	23EC212	Adaptive Signal Processing
13	23EC213	Real Time Concepts for Embedded Systems
14	23EC214	Image Processing and Computer Vision
15	23EC215	ASIC Design Flow

Paper 3		
Sl.No.	Course Code	Course Name
1	23EC301	Bio Medical signal Processing
2	23EC302	Advanced Embedded Processor Architecture
3	23EC303	Wireless Cellular Communications
4	23EC304	Natural Language Processing
5	23EC305	Advanced Computational Mathematics
6	23EC306	EMI/EMC
7	23EC307	MEMS Measurement Techniques
8	23EC308	Antenna Measurements
9	23EC309	VLSI System Design
10	23EC310	MOS Circuit Design
11	23EC311	Testing of VLSI Circuits
12	23EC312	Advanced Analog IC Design
13	23EC313	Microwave and Millimeter wave Circuits
14	23EC314	Pattern Recognition
15	23EC315	CMOS RF Circuit Design

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Annexure-IX

The following are the list of value-added courses for the academic year 2023-2024.

	Name of the add on/certificate/value added program/Diploma Programs/ online course of MOOCS/SWAYAM/e Patashala/ NPTEL etc	Program duration (No of contact Hours)
STREAM	Name of the Certificate Course	40 hrs
IOT	IOT Analytics & Data Sciences	
	Advanced IOT Analytics with Machine Learning	
	IOT & Industrial Automation	40 hrs
VLSI	Verification using system verilog	
	Fundamentals of UVM (Universal Verification Methodology)	
	Synthesis & Timing Analysis	
	Physical Design & system Verification	
	VLSI-Advanced Design & Verification- System Verilog and UVM	40 hrs
RF	RF Systems-Modelling, Design and Simulation	40 hrs
SIGNAL PROCESSING	Huawei Certified ICT Associate Artificial Intelligence (HCIA-AI)	
	Huawei Certified ICT Associate Routing and Switching (HCIA-R&S)	40 hrs
WIRELESS COMMUNICATION	Huawei Certified ICT Associate Artificial Intelligence (HCIA-AI)	
	Huawei Certified ICT Associate Routing and Switching (HCIA-R&S)	40 hrs
DATA COMMUNICATION	Huawei Certified ICT Associate Artificial Intelligence (HCIA-AI)	
	Huawei Certified ICT Associate Routing and Switching (HCIA-R&S)	40 hrs
DATA COMPUTING	Huawei Certified ICT Associate Artificial Intelligence (HCIA-AI)	
	Huawei Certified ICT Associate Routing and Switching (HCIA-R&S)	
	IOT Analytics & Data Sciences - Level 1	
	Advanced IOT Analytics with Machine Learning - Level 2	40 hrs
BIO MEDICAL INSTRUMENTATION	Medical Equipment	40 hrs

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