XXIV Academic Council - Annexure 4

Date: 20 May 2018

Department of Electronics and Communication Engineering

Minutes of 24th Board of Studies Meeting

The Department of Electronics and Communication Engineering conducted the Board of Studies meeting on 20 May 2018, offline mode, at F008 from 11.00 AM onwards

Following members were present in the meeting

1. Dr. M. Suman, Professor and HoD, BoS Chair,
2. Dr. Vinay Kumar Mittal, Professor & Dept. Chair, Member
3. Mr. V. Ramani Kumar, Advisor & Adj. Professor, Member
4. Dr. L. Koteswara Rao, Professor & HOD-ECE, KLH, Member
5. Dr. V. Anil Kumar, Asst. Professor, IIIT Hyderabad, Member
6. Dr. Habibullah Khan, Professor & Dean Student Affairs, Member
7. Dr. K.Sarat Kumar, Professor, Member
8. Dr. K.Ch. Sri Kavya, Professor, Member
9. Dr. M Venkata Narayana, Professor & DHOD, Member
10. Dr. M.Siva Ganga Prasad, Professor & DHOD, Member
11. Dr. Lakshman Pappula, Assoc. Professor & DHOD, Member
12. Dr. 1.Govardhani, Professor & RPAC, Member
13. Dr. M Sridhar, Professor, Member
14. Dr. S Koteswara Rao, Professor, Member
15. Dr. G V Subbarao, Professor & RPAC, Member
16. Dr. M Venugopal Rao Professor & Assoc, Dean IQAC, Member
17. Dr. BTP Madhav, Professor & Assoc. Dean R&D, Member
18. Dr. D Venkat Ratnam, Professor, Member
19. Dr. K Srinivas Rao, Professor, Member
20. Dr. K Kumar Naik, Professor, Member
21. Dr. V. S. V. Prabhakar, Professor & Director IC, Member
22. Dr. Madhukar Deshmukh, Professor & Assoc. Dean, Member
23. Dr. T.V.Rama Krishna, Professor & Director (E- resources) , Member
24. Dr. K.S.Kamesh, Professor, Member
25. Dr. Md. Z Rehman, Professor, Member
26. Dr. B. Polaiah, Professor, Member
27. Dr. Raja Chandrasekaran, Professor, Member
28. Dr. D. Sree Phani Kishore, Professor, Member
29. Dr. Fazal Noorbasha, Assoc. Professor & Assoc.Dean, Member
30. Dr. G. Naveen Kishore, Assoc. Professor, Member
31. Mr M. Ravi Kumar, Asst. Professor, Member
32. Dr. M. Goutham, Asst. Professor, ECE, KLH, Member
33. Dr. V S Bhagavan, Professor, Mathematics, Special Invitees
34. Dr. M. Venkateswarlu, Asst. Professor Physics, Special Invitees
35. Dr. V Shanmukha Kumar, Professor. Chemistry, Special Invitees
36. Dr. GS Krishna Santosh, Assoc. Professor, ECE Dept, Special Invitees
37. Dr. C. Sandeep Reddy, Asst. Professor, ECE, KLH, Special Invitees

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38. Dr KS. Ramesh, Special Invitees

The following members are absent

1. Dr. T. Kishore Kumar, Professor, NIT Warangal, Member
2. Dr. V Rajesh, Professor & Dean P & D, Member
3. Dr. A.S.C.S.Sastry, Professor & COE, Member
4. Dr. P Satyanarayana, Professor & HOD ECM, Member
5. Dr. PVV Kishore, Professor, Member
6. Dr. K. Hari Kishore, Professor, Member
7. Dr. P.Pardhasaradhi, Professor, Member
8. Dr. N Venkatram, Professor & Dean Academics, Special Invitees
9. Dr. Subba Rao, Head Budget, P&M division, NRSC, Bengaluru, Special Invitees
10. Mr. Visweswaran Jagadeesan, National Instruments, Bengaluru, Special Invitees
11. Dr. MR Narasinga Rao, Professor, CSE, Special Invitees
12. Dr. Kalyan Chakravarthy, Professor, Mech, Special Invitees
13. Dr. J Somlal, Professor, EEE, Special Invitees
14. Dr. K Giridhar, Assoc. Professor Biotechnology, Special Invitees
15. Dr. CV Ramani, Asst. Professor, CSS, Special Invitees
16. Dr. B Siva Nagaiah, Assoc. Professor, English, Special Invitees
17. Dr. Bindu Madhavi Narayanam, Asst. Professor. MBA, Special Invitees
18. Mr. K. Sripath Roy, Asst. Professor & Assoc. Dean, ECE Dept. Special Invitees

AGENDA and RESOLUTIONS

AGENDA ITEM-1

Approval of DAC minutes of meeting	Recommended and forwarded to AC for approval

The minutes of the DAC meeting held on 20-05-2018 were discussed among the members. The minutes were approved.

[Annexure I]

AGENDA ITEM-2

Approval of the action taken report on feedback analysis on curriculum from DAC meeting	Recommended and forwarded to AC for approval

BOS Members discussed the recommendation from the DAC minutes and the status is given in the Annexure II.

[Annexure II]

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AGENDA ITEM- 3

Approval of Course and Semester Structure for B. Tech Y18 Regulation	Recommended and forwarded to AC for approval

All the BoS members approved the Y18 course structure and the courses mentioned in the structure are forwarded to Dean Academics for further approval.

[Annexure III]

AGENDA ITEM-4

Approval on Y18 Employability, Entrepreneurship, Skill Development Courses	Recommended and forwarded to AC for approval

All the BoS members approved the Employability, Entrepreneurship, Skill Development Courses in Y18 course structure.

[Annexure III]

AGENDA ITEM-5

Approval of new M. Tech Atmospheric science program for AY 2018-19	Recommended and forwarded to AC for approval

All the BoS members approved the new M. Tech specialization in Atmospheric science. Based on the survey and industrial requirements BOS introduced new M. Tech program Atmospheric Science. A M.Tech program in Atmospheric Science holds significant importance by providing students with a comprehensive understanding of the Earth's atmosphere, its dynamics, and interactions. Graduates are well-equipped to contribute to environmental solutions, climate change mitigation, and sustainable development. The program's focus on weather prediction enhances disaster management capabilities, while expertise in air quality monitoring is crucial for addressing pollution and safeguarding public health. Additionally, M.Tech graduates play a vital role in advancing renewable energy technologies by applying their knowledge of atmospheric conditions. Through research, innovation, and collaboration on a global scale, these professionals contribute to cutting-edge developments in climate modelling and satellite technology, influencing policy formulation and fostering a holistic approach to addressing pressing environmental challenges. Overall, M.Tech in Atmospheric Science prepares individuals to make meaningful contributions across diverse fields, promoting a sustainable and resilient future.

The course structure and syllabus are detailed in Annexure-III.

[Annexure III]

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AGENDA ITEM-6

Resolved to revise core and electives courses for B. Tech ECE for AY 2018-19 based on stake holders feedback	Recommended and forwarded to AC for approval

Resolved to approve the revision of core and electives courses for B. Tech ECE from AY 2018-19 based on stake holders feedback.

- Based on the feedback received from Dr. V. Anil Kumar IIIT Hyderabad, Syllabus for "Analog Electronic Circuit Design (18EC2103)" is revised for B. Tech ECE. The proposed modifications also emphasize interdisciplinary integration, acknowledging the increasing interconnectedness of analog electronic circuit design with other engineering disciplines. Lastly, considerations for accessibility and inclusivity cater to diverse learning styles and needs, fostering a more inclusive educational environment. The modification, therefore, seeks to enhance the course's overall quality and relevance.
- Based on the feedback received from Mr. Pavan Srinivas (160040614), Syllabus for "Embedded Controllers (18EC2205)" is Revised for B. Tech ECE. The modification of the syllabus for the Embedded Controllers course is justified to enhance the overall learning experience and relevance of the content to current industry trends. In the rapidly evolving field of embedded systems, it is imperative to align the course curriculum with the latest technological advancements, emerging standards, and industry demands.
- Based on the feedback received from Dr. T. Kishore Kumar, NIT Warangal, "Analog and digital communication (18EC2206)" is revised for B. Tech ECE. The revision of Analog and Digital Communication is essential to address the evolving landscape of communication technologies and to equip students with the skills necessary for the modern workforce. As communication technologies continue to advance at a rapid pace, the integration of both analog and digital communication principles becomes crucial for understanding and navigating this complex domain.
- Based on the feedback received from Dr. P.V.V. Kishore, Syllabus for "Data Networks & Protocols (18EC3109)" is Revised for B. Tech ECE. The modification aims to incorporate the latest advancements, emerging technologies, and industry best practices, providing students with a comprehensive understanding of contemporary networking concepts and protocols.

S. No.	Course Code	Course Title	% of syllabus revised	Year of offering
1	18EC2103	Analog Electronic Circuit Design	60%	2nd
2	18EC2205	Embedded Controllers	50%	2nd
3	18EC2206	Analog and digital communication	50%	2nd

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4	18EC3109	Data Networks & Protocols	50%	3rd

The detailed syllabus modification are shown in Annexure IV

[Annexure IV]

AGENDA ITEM-7

Proposed to introduce courses for B. Tech ECE for AY 2018-19 based on stake holders feedback	Recommended and forwarded to AC for approval

Resolved to approve the addition of new courses for B. Tech ECE from AY 2018-19 based on stake holders feedback.

- Based on the feedback received from alumni person Mr. Vamsi. Ch., ThirdLeap Inc., "Advance Course in Soft-Computing (18EC3021)" is introduced as a flexi core courses to promote the skill development in soft computing techniques. The introduction of the Advanced Course in Soft-Computing is a strategic response to the growing demand for professionals skilled in the interdisciplinary field of soft computing. As technology continues to advance, the integration of artificial intelligence, machine learning, and fuzzy logic has become increasingly prevalent in various industries. This course aims to fill a critical gap in the education landscape by offering a specialized program that delves into advanced concepts and applications within soft computing.

- Based on the feedback received from Dr.I.Govardhani, "Wireless Sensor Networks & IOT Applications (18EC3051)" is introduced as elective for enhancing employment opportunity in wireless sectors. This course will equip students with a profound understanding of the underlying principles, protocols, and technologies governing wireless sensor networks, as well as the practical skills to develop and deploy IoT applications. By bridging theoretical concepts with hands-on experiences, the course not only addresses the current industry demand for IoT expertise but also ensures that students are well-prepared to contribute to the ongoing technological advancements and innovations in this rapidly evolving field.

- Based on the feedback received from industrial person Dr. Subba Rao, NRSC Bangalore, "Control Systems & Introduction to Robotics (18EC3071)" is introduced as elective course for developing skills concerning robotics for industrial automation. As industries increasingly embrace automation and robotics to enhance efficiency and productivity, there is a pressing need for engineers well-versed in the principles of control systems and the fundamentals of robotics. This course fills a critical gap in our curriculum by providing students with a comprehensive understanding of control theory, system dynamics, and the practical application of these concepts in the field of robotics.

- Based on the feedback received from Mr. Visweswaran Jagadeesan, NI Bangalore, "4G Wireless Technologies & Cellular Communications (18EC3092)" is introduced as elective

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course for enhancing employment opportunity in wireless sectors. With the relentless evolution of communication networks, there is an increasing demand for professionals well-versed in the intricacies of 4G wireless technologies and cellular communications. This course aims to bridge the knowledge gap by offering students a comprehensive understanding of the advanced principles, protocols, and architectures that underpin 4G networks. The integration of topics such as LTE (Long-Term Evolution), WiMAX, and advanced cellular communication protocols will empower students to navigate the complexities of modern wireless systems.

- Based on the feedback received from Mr. Srinivas Vedala, Apple Inc. industrial person, new course "Electromagnetic Fields & Applications (18EC2112)" is introduced to strengthen the fundamental of electronics for industrial requirement instead of computer networks (17EC3107). The modification of the Electromagnetic Fields & Applications course syllabus is imperative to enhance the relevance and effectiveness of the curriculum in light of evolving technological advancements and industry requirements. In the rapidly changing landscape of electromagnetic fields, emerging technologies such as 5G, IoT, and electric vehicles demand a more comprehensive understanding of electromagnetic principles.

- Based on the feedback received from academic peer Dr. Narendhar. C, "Electronic Instruments & Biomedical Applications (18EC4084)" is introduced as elective course for better employment in biomedical fields. In today's technological landscape, electronic instruments play a pivotal role in advancing healthcare by facilitating accurate diagnostics, monitoring, and treatment. This course aims to bridge the gap between electronics and biomedical applications, equipping students with specialized knowledge in designing, developing, and implementing electronic instruments for medical purposes. With a focus on cutting-edge technologies such as medical sensors, imaging devices, and wearable health monitoring systems, the course will empower students to contribute to the rapidly evolving field of biomedical engineering.

S. No.	Course Code	Course Title	Course Type	Remarks
1.	18EC3021	Advance Course in Soft-Computing	Professional elective	This course is introduced as elective based on stake holders feedback
2.	18EC3051	Wireless Sensor Networks & IOT Applications	Professional elective	This course is introduced as elective based on stake holders feedback
3.	18EC3071	Control Systems & Introduction to Robotics	Professional Elective	This course is introduced as elective based on stake holders feedback

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4.	18EC3092	4G Wireless Technologies & Cellular Communications	Professional Elective	This course is introduced as elective based on stake holders feedback
5.	18EC2112	Electromagnetic Fields & Applications	Professional core	This course is introduced as core based on stake holders feedback
6.	18EC4084	Electronic Instruments & Biomedical Applications	Professional elective	This course is introduced as elective based on stake holders feedback

The detailed syllabus for newly included courses are shown in Annexure IV

[Annexure IV]

AGENDA ITEM-8

Approval of the new course "IC Fabrication Technology (18EC5131)" for M. Tech VLSI based on stakeholders feedback	Recommended and forwarded to AC for approval

Resolved to approve of the additional course IC Fabrication Technology (18EC5131) in M. Tech, AY 2018-19 upon the recommendation from industry personnel for skill development and employment opportunity.

- Based on the feedback received from Mr. R Nagesh,, CDAC, Bengaluru, "IC Fabrication Technology (18EC5131)" is introduced for M. Tech VLSI. This course addresses a critical gap in our curriculum, enabling students to gain comprehensive insights into the intricacies of IC fabrication. By covering topics such as cleanroom protocols, photolithography, deposition techniques, and etching processes, students will acquire practical skills essential for designing and producing semiconductor devices.

[Annexure IV]

AGENDA ITEM-9

Approval of Value-Added Courses.	Recommended and forwarded to AC for approval

Resolved to approve the list of value-added courses upon the survey of local, national and global technical needs.

[Annexure V]

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AGENDA ITEM-10

Any other points as per the discretion of the BoS chairman	Recommended and forwarded to AC for approval

1. Dr. M. Venkata Narayana suggested to explore the integration of IOT to B. Tech and M. Tech programs
2. Dr. Anil Kumar suggested the inclusion of nanotechnology concepts for B. Tech programs.
3. Dr. Kishore Kumar suggested to review the titles of electives.
4. Dr. Kishore Kumar Suggested to develop M. Tech course structure in accordance with AICTE guidelines.
5. Dr. Anil Kumar suggested to have course codes according to the level of the course.

Based on the suggestions given by the members, the BoS resolved to approved and forwarded the resolutions to the Academic Council for further approval.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATIONS ENGINEERING

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BOS MEETING

S. No	Name of the Faculty	Designation	Signature
1	Dr. M. Suman, Professor & HOD	BOS Chair	
2	Dr. Vinay Kumar Mittal, Professor & Dept. Chair	Member	
3	Mr. V. Ramam Kumar, Advisor & Adj. Professor	Member	
4	Dr. L. Koteswara Rao,Professor & HOD-ECE, KLH	Member	
5	Dr. V. Anil Kumar, Asst. Professor, IIIT Hyderabad	External Member	
6	Dr. T. Kishore Kumar, Professor, NIT Warangal	External Member	
7	Dr. Habibullah Khan, Professor & Dean Student Affairs	Member	
8	Dr. V Rajesh, Professor & Dean P & D,	Member	
9	Dr. K Sarat Kumar, Professor	Member	
10	Dr. A.S.C.S Sastry, Professor & COE	Member	
11	Dr. K.Ch.Sri Kavya, Professor	Member	
12	Dr. M Venkata Narayana, Professor & DHOD	Member	
13	Dr. M Siva Ganga Prasad, Professor & DHOD	Member	
14	Dr. Lakshman Pappula, Assoc. Professor & DHOD	Member	
15	Dr. I.Govardhani, Professor & RPAC	Member	
16	Dr. P Satyanarayana, Professor & HOD ECM	Member	
17	Dr. P V V Kishore, Professor	Member	
18	Dr. M Sridhar, Professor	Member	
19	Dr. S Koteswara rao, Professor	Member	
20	Dr. G V Subbarao, Professor & RPAC	Member	
21	Dr. M Venugopal Rao Professor & Assoc. Dean IQAC	Member	
22	Dr. B T P Madhav, Professor & Assoc. Dean R&D	Member	
23	Dr. D Venkat Ratnam, Professor	Member	
24	Dr. K Srinivas Rao, Professor	Member	
25	Dr. K Kumar Naik, Professor	Member	
26	Dr. V. S. V. Prabhakar, Professor & Director IC	Member	
27	Dr. Madhukar Deshmukh, Professor & Assoc. Dean R&D	Member	
28	Dr. T.V.Rama Krishna, Professor & Director (E-resources)	Member	
29	Dr. K S Ramesh, Professor	Member	
30	Dr. K Hari Kishore, Professor	Member	
31	Dr. Md Z Rehman, Professor	Member	
32	Dr. P.Pardhasaradhi, Professor	Member	
33	Dr. B.Polaiah, Professor	Member	

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33	Dr. Rao Chandrashekaran, Professor	Member	
34	Dr. D Sree Phani Kishore, Professor	Member	
36	Dr. Fazal Noorbasha, Assoc. Professor & Assoc.Dean	Member	
37	Dr. G. Naveen Kishore, Assoc. Professor	Member	
38	Mr. M. Ravi Kumar, Asst. Professor	Member	
39	Dr. M. Goutham, Asst. Professor, ECE, KLH	Member	

Special Invitees

1	Dr. N VenkatRam, Professor & Dean Academics	Special Invitee	
2	Dr. Subba Rao, Head Budget, P&M division, NRSC, Bengaluru	Special Invitee	
3	Mr. Visweswaran Jagadeesan, National Instruments, Bengaluru	Special Invitee	
4	Dr. M R Narasinga Rao, Professor, CSE	Special Invitee	
5	Dr. Kalyan Chakravarthy, Professor, Mech	Special Invitee	
6	Dr J Somlal, Professor, EEE	Special Invitee	
7	Dr. V S Bhagavan, Professor, Mathematics	Special Invitee	
8	Dr. M. Venkateswarlu, Asst. Professor ,Physics	Special Invitee	
9	Dr. K Giridhar, Assoc. Professor ,Biotechnology	Special Invitee	
10	Dr. C V Ramani, Asst. Professor , CSS	Special Invitee	
11	Dr. B Siva Nagaiah, Assoc. Professor , English	Special Invitee	
12	Dr. Bindu Madhavi Narayanam, Asst. Professor , MBA	Special Invitee	
13	Dr. V Shanmukha Kumar, Professor , Chemistry	Special Invitee	
14	Dr. Sai Krishna Santosh G, Assoc. Professor, ECE Dept.	Special Invitee	
15	Mr K. SripathRoy, Asst. Professor & Assoc. Dean, ECE Dept.	Special Invitee	
16	Dr C. Sandeep Reddy, Asst.Professor, ECE, KLH	Special Invitee	
17	Dr K.S. Ramesh		

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Annexure I

DAC minutes of meeting is enclosed

Annexure II
Feedback Analysis

Sl.No.	Name of the resource person	Designation & Affiliation	Recommendation on Curriculum during DAC meeting	Approval by BOS committee	Remarks
A.	**Industry Personnel**				
1.	Mr. R Nagesh	Associate Director, CDAC, Bengaluru	recommended to add IC Fabrication Technology course to the M. Tech curriculum	Approved	For skill development and employment opportunity
2.	Mr. Srinivas Vedala	Apple Inc., Bengaluru	suggested to include a course called Electromagnetic Fields and Applications	Approved	strengthen the fundamental of electronics for industrial requirement
3.	Dr. Subba Rao	Head Budget, P&M division, NRSC, Bengaluru	suggested to include a course on Control Systems and Robotics	Approved	For fundamental robotic skill development
4.	Mr. Visweswaran Jagadeesan	National Instruments, Bengaluru	suggested 4G Wireless Technologies and Cellular Communication should be included	Approved	Necessary to update the recent wireless technology
5.	Mr. M. Kannan	Honeywell, Bangalore	Suggested to add Technical Skill - 1 (Coding)	Approved	To develop the coding skills to meet industrial requirement
B.	**Academic Peers**				

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6.	Dr. V.Anil Kumar	IIIT Hyderabad	suggested to include the basics of diodes, BJT transistors, Op amps and oscillators in more detail in Analog Electronic Circuit Design course	Approved	Necessary for the project based learning
7.	Dr. T.Kishore Kumar	NIT Warangal	suggested to include basics of telecom systems in the course- Analog and Digital Communications	Approved	Necessary for the project based learning
8.	Dr. Selvarajan. E	Assistant professor, SRM Institute of Science and Technology, Chennai, Tamil Nadu	Suggested to add Technical Skill - 2 (Coding) in the curriculum	Approved	To develop the coding skills
9.	Dr. Narendhar. C	Research Assistant professor, Jeju University, South Korea.	Suggested to include Electronic Instruments & Biomedical Applications	Approved	To gain knowledge in biomedical electronics for employment in industries
C.	**Alumni**				
10.	Vamsi .Ch	Third Leap	recommended to include Advance Course in Soft-Computing in the curriculum	Approved	To meet the demand of IT sector in terms of employment
D.	**Faculty**				
11.	Dr. S. Koteswara Rao	K. L. University	Suggested to include recent trends in signal processing	Approved	To understand upcoming signal processing techniques

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12.	Dr. B. T. P. Madhav	K. L. University	Suggested to include advanced concepts into Antennas and Wave Propagation	Approved	To understand recent advances in Antennas
13.	Dr. P.V.V. Kishore	K. L . University	Suggested to change syllabus of data network and protocol	Approved	To meet the global standards
14.	Dr. Govardhani	K. L . University	Suggested to include of Wireless Sensor Networks & IOT Applications	Approved	To boost employment in wireless sector
E.	**Student**				
15.	160040614, Narayana Pavan Srinivas	K. L. University	suggested to include basics of some advanced microcontrollers like ARM7 and CORTEX (STM32) in Embedded Controllers	Approved	To enrich the knowledge in embedded system for better employment

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Annexure III

Y18 Course structure of B. Tech.

HUMANITIES AND SOCIAL SCIENCE COURSES												
Sl No	**Course Code**	**Course Title**	**Type**	**Uni/Sch/Dept**	**L-T-P-S**	**Cr**	**CH**	**Pre-Req**	**Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development**	**Course Category**	**New Course (Yes/No)**	**Remarks**
1	18UC1101	Basic English	HSS	UNI CORE	0-0-4-0	2	4	NIL	ENTREPRENEURSHIP	Case Studies based learning	No	
2	18UC1202	English Proficiency	HSS	UNI CORE	0-0-4-0	2	4	NIL	ENTREPRENEURSHIP	Case Studies based learning	No	
3	18UC2103	Professional Communication Skills	HSS	UNI CORE	0-0-4-0	2	4	NIL	ENTREPRENEURSHIP	Case Studies based learning	No	
4	18UC2204	Aptitude Builder -1	HSS	UNI CORE	0-0-4-0	2	4	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
5	18UC3105	Aptitude Builder -2	HSS	UNI CORE	0-0-4-0	2	4	NIL	EMPLOYABILITY	Practice based learning,	No	

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										Problem Solving		
6	18UC3206	Campus to Corporate	HSS	UNI CORE	0-0-4-0	2	4	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
7	18FLXX	Foreign Language	HSS	UNI ELEC	2-0-0-0	2	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
8	18UC0007	Indian Heritage and Culture	HSS	UNI CORE	0-0-2-0	0	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
9	18UC0008	Indian Constitution	HSS	UNI CORE	0-0-2-0	0	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
10	18UC0009	Ecology & Environment	HSS	UNI CORE	2-0-0-0	2	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
11	18UC0010	Universal Human Values & Professional Ethics	HSS	UNI CORE	1-0-2-0	2	3	NIL	EMPLOYABILITY / ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
12		Management Elective	HSS	SCH ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY / ENTREPRENEURSHIP	Practice based	No	

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										learning, Problem Solving		
BASIC SCIENCE COURSES												
13	18SC1103	Single Variable Calculus and Matrix Algebra	BS	SCH CORE	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
14	18MT1201	Multivariate Calculus / Basic Mathematics	BS	SCH ELEC	3-0-2-0	4	5	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
15	18SC1105	Logic and Reasoning	BS	SCH CORE	0-0-2-0	1	2	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
16	18SC1104	Foundations of Computational Mathematics	BS	SCH CORE	0-0-2-0	1	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
17	18SC2008	Discrete Mathematics	BS	SCH ELEC	2-1-0-0	3	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
18	18BT1001	Biology for Engineers	BS	SCH ELEC	2-0-0-0	2	2	NIL	EMPLOYABILITY	Practice based learning,	No	

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										Problem Solving		
19	18PH3005	Physics for Electronics Engineers	BS	SCH ELEC	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
20	18CY1001	Engineering Chemistry	BS	SCH ELEC	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
ENGINEERING SCIENCE COURSES												
21	18SC1101	Problem Solving and Computer Programming	ES	SCH CORE	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
22	18SC1202	Data Structures	ES	SCH CORE	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
23	18EC1002	Engineering Graphics & Design for Electronics and Computer Engineers	ES	SCH ELEC	0-0-4-0	2	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
24	18EE1003	Workshop Practice for Electrical and Electronics Engineers	ES	SCH ELEC	0-0-4-0	2	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	

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25	18MT2009	Probability Theory & Stochastic Processes	ES	SCH ELEC	2-1-0-0	3	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
26	18SC2009	Object Oriented Programming	ES	SCH ELEC	2-0-2-0	3	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
27	18EC2112	Electromagnetic Fields & Transmission Lines	ES	SCH ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	Added by the recommendation of industrial feedback to strengthen the fundamental of electronics
28	18EE2105	Electrical Circuit Theory	ES	SCH ELEC	3-1-0-0	4	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
PROFESSIONAL CORE COURSES												
29	18EC1101	Digital System Design	PC	DEPT CORE	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
30	18EC1202	Computer Organization and Architecture	PC	DEPT CORE	3-0-0-0	3	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	

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31	18EC2103	Analog Electronic Circuit Design	PC	DEPT CORE	3-0-4-0	5	7	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	Changed by the recommendation of academic peer feedback to match global standards
32	18EC2104	Signals and Systems	PC	DEPT CORE	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
33	18EC2205	Processors and Controllers	PC	DEPT CORE	2-1-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Nc	
34	18EC2206	Analog and Digital Communication	PC	DEPT CORE	2-1-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	yes	Added by the recommendation of academic peer feedback to improve the employment oppourtunity
35	18EC2207	Digital Signal Processing	PC	DEPT CORE	2-1-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
36	18EC2208	VLSI Design	PC	DEPT CORE	2-1-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	

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37	18EC3021	Advance Course In Soft-Computing	FC	DEPT CORE	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	Added by the recommendation of Alumini feedback to develop skilling
38	18EC3109	Data Networks and Protocols	PC	DEPT CORE	3-0-2-0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	Changed by the recommendation of faculty feedback for better employment opportunity in communication sector
39	18EC3110	Electronic System Design Workshop	PC	DEPT CORE	2-0-4-0	4	6	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
40	18EC4111	Wireless Communications	PC	DEPT CORE	3-0-0-0	3	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
PROFESSIONAL ELECTIVES												
41		Professional Elective - 1	PE	DEPT ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
42		Professional Elective - 2	PE	DEPT ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning,	No	

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										Problem Solving		
43		Professional Elective - 3	PE	DEPT ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
44		Professional Elective - 4	PE	DEPT ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
45		Professional Elective - 5	PE	DEPT ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
46		Professional Elective - 6	PE	DEPT ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
OPEN ELECTIVES												
47		Open Elective Course - 1	OE	UNIV ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
48		Open Elective Course - 2	OE	UNIV ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
49		Open Elective Course - 3	OE	UNIV ELEC	3-0-0-0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	

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PROJECT/ TERM PAPER/ INDUSTRIAL TRAINING											
50	18IE2246	Industrial Training	PR	SCH CORE	0-0-0-0	2	0	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
51	18IE3247	Term Paper	PR	SCH CORE	0-0-4-0	2	4	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
52	18IE4049/ 18IE4048	Practice School / Project (Part - 1)	PR	SCH CORE	0-0-12-0	6	12	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
53	18IE4049/ 18IE4050/ 18IE4051	Practice School / Project (Part - 2)/ Internship	PR	SCH CORE	0-0-12-0	6	12	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
SKILLING COURSES											
54	18SC1106	Technical Skill - 1 (Coding)	SK	SCH CORE	0-0-0-8	2	8	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes Added by the recommendation of industrial feedback to develop technical skilling for job
55	18SC1207	Technical Skill - 2 (Coding)	SK	SCH CORE	0-0-0-6	1.5	6	NIL	SKILL DEVELOPMENT	Practice based learning,	Yes Added by the recommendation of industrial

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										Problem Solving		feedback to develop technical skilling for job
56	18TS401	Technical Skilling-1 (Lab View and MultiSim)	SK	SCH ELEC	0-0-0-8	2	8	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
57	18TS402	Technical Skilling-2 (Matlab) (Communications and DSP)	SK	SCH ELEC	0-0-0-8	2	8	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
58	18TS403	Technical Skilling-3 (VLSI-Xilinx-Vivado, ES-Keil& ARM, SP-Python, CS-Tems, ML&AI-Keras)	SK	SCH ELEC	0-0-0-6	1.5	6	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
59	18TS404	Technical Skilling-4 (VLSI-MentorGraphics, ES-Python& RasberriPie, SP-Python; CS-BTS simulators, ML&AI-Tensor Flow)	SK	SCH ELEC	0-0-0-6	1.5	6	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
60	18TS405	Technical Skilling-5 (VLSI-Pspice or Cadence, ES-CC Studio, SP-VC++, CS-HFSS-CST, ML&AI-Spider)	SK	SCH ELEC	0-0-0-8	2	8	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
COUNSELING AND CO-CURRICULAR ACTIVITIES												

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61	18GN1101	Counseling -1	CNS	SCH CORE	0-0-1-0	0	1	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
62	18GN1202	Counseling -2	CNS	SCH CORE	0-0-1-0	0	1	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
63	18GN2103	Counseling -3	CNS	SCH CORE	0-0-1-0	0	1	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
64	18GN2204	Counseling -4	CNS	SCH CORE	0-0-1-0	0	1	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
65	18GN3105	Counseling -5	CNS	SCH CORE	0-0-1-0	0	1	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
66	18GN3206	Counseling -6	CNS	SCH CORE	0-0-1-0	0	1	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
67	18GN1107	Co-curricular Activity -1	CCA	SCH CORE	0-0-0-2	0.5	2	NIL	SKILL DEVELOPMENT	Practice based learning,	No	

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68	18GN1208	Co-curricular Activity -2	CCA	SCH CORE	0-0-0-2	0.5	2	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
69	18GN2109	Co-curricular Activity -3	CCA	UNI CORE	0-0-0-2	0.5	2	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
70	18GN2210	Co-curricular Activity -4	CCA	UNI CORE	0-0-0-2	0.5	2	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
71	18GN3111	Co-curricular Activity -5	CCA	SCH CORE	0-0-0-2	0	2	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
72	18GN3212	Co-curricular Activity -6	CCA	SCH CORE	0-0-0-2	0	2	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No
BRIDGE / REFRESHER COURSES											
73		Bridge/ Refresher Course in Mathematics	BS	SCH ELEC	0-0-2-0	0	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No

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74		Bridge/ Refresher Course in Physics	BS	SCH ELEC	0-0-2-0	0	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
75		Bridge/ Refresher Course in Chemistry	BS	SCH ELEC	0-0-2-0	0	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
76		Bridge/ Refresher Course in English	HSS	SCH ELEC	0-0-2-0	0	2	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
INDUCTION COURSES (NON CREDIT)												
77	18IN1001	Fundamentals of Mathematics	BS	SCH CORE	5-0-0-0	0	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
78	18IN1002	Basics of Physics	BS	SCH CORE	5-0-0-0	0	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
79	18IN1003	Introduction to Engineering	ES	SCH CORE	5-0-0-0	0	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
80	18IN1004	Human Values	HSS	SCH CORE	5-0-0-0	0	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based	No	

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										learning, Problem Solving		
81	18IN1005	SWEAR Analysis	ES	SCH CORE	5-0-0-0	0	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
82	18IN1006	Cocurricular Activities	GN	SCH CORE	5-0-0-0	0	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
CAMPUS RECRUITMENT AND TRAINING COURSES												
83		Technical Proficiency & Training -1	HSS & ES	SCH ELEC	0-0-0-4	1	4	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
84		Technical Proficiency & Training -2	HSS & ES	SCH ELEC	0-0-0-8	2	8	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
		Total			90-7-98-128	171.5	321					

SKILL BASED PROFESSIONAL ELECTIVES

SIGNAL AND IMAGE PROCESSING DOMAIN

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Sr. No.	Course Code	Course Name	L	T	P	CR	CH	Pre-Req.	Activities / Content with direct bearing on Employability / Entrepreneurship / Skill development	Course Category	New Course (Yes/No)	Remarks
1	18EC3051	Wireless sensor Networks & IoT Applications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	Yes	Added by the recommendation of faculty feedback better employment opportunity in communication sector
2	18EC3052	Artificial neural networks	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
3	18EC3053	Fuzzy logic	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
4	18EC3054	Machine Learning	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning,	No	

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										Problem Solving		
5	18EC3055	Computer vision & Applications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
6	18EC3056	Pattern Recognition	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
7	18EC3057	Human Machine Interaction	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
8	18EC3058	Video Surveillance	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
9	18EC3059	Audio Signal Processing	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	

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10	18EC3060	Statistical Signal Processing	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
11	18EC3071	Control Systems & Introduction to Robotics	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	YES	Added by the recommendation of industrial feedback to improve the skills
12	18EC3061	Adaptive Signal Processing	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
13	18EC4062	Bio Medical Signal Processing	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
14	18EC4063	Biomedical Imaging	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
15	18EC4064	Knowledge Based Systems	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based	No	

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MOBILE AND COMMUNICATIONS DOMAIN												
1	18EC3065	Information Theory and Coding	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
2	18EC3066	Antennas and Wave Propagation	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
3	18EC3067	Microwave Engineering	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
4	18EC3068	Optical communications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
5	18EC3069	Electronic Navigation systems	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning,	No	

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6	18EC3070	RF System Design	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
7	18EC3071	Satellite Communications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
8	18EC3072	Smart Antennas	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
9	18EC4073	RADAR Engineering	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
10	18EC4074	EMI/EMC	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	

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		VLSI DESIGN DOMAIN										
1	18EC3075	VLSI Technology	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
2	18EC3076	VLSI subsystem design	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
3	18EC3077	Digital IC Design and Applications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
4	18EC3078	Design For Testability	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
5	18EC3079	Analog VLSI Design	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	

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6	18EC3080	MEMS Technology	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
7	18EC3081	Low Power VLSI	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
8	18EC3082	Nano Electronics	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
9	18EC4083	CAD for VLSI Design	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
10	18EC4084	Electronic Instruments & Biomedical Applications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	YES	Added by the recommendation of Academic peer feedback for employment in biomedical fields
COMPUTER COMMUNICATIONS DOMAIN												

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1	18EC3085	Data networks & Protocols	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
2	18EC3086	Broadband Networks	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
3	18EC3087	TCP/IP Protocol Suite	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
4	18EC3088	VOIP systems	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
5	18EC3089	5G Mobile and Wireless Technology	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
6	18EC3090	Mobile Cloud Computing	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning,	No	

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										Problem Solving		
7	18EC3091	Cloud Networking	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
8	18EC3092	4G Wireless Technologies & Cellular Communications	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	YES	Added by the recommendation of industrial feedback to keep up with new technology
9	18EC4093	WLAN 802 Standards	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
10	18EC4094	IP-Multimedia subsytem (IMS)	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	
11	18EC4095	Emerging Technologies in Computer Communications (Cloud, IoT, NFV and SDN)	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning, Problem Solving	No	

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S.No	Course Code	Course Name	L	T	P	CR	CH	Pre-Req.	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New Course (Yes/No)	Remarks
OPEN ELECTIVES												
1	18 BT 40A1	IPR & Patent Laws	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
2	18 CE 40A2	Environmental Pollution Control Methods	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
3	18 CE 40A3	Solid and Hazardous waste management	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
4	18 CE 40A4	Remote Sensing & GIS	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
5	18 CE 40A5	Disaster Management	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	

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6	18 CS 40A6	Fundamentals of DBMS	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
7	18 CS 40A7	Fundamentals of Software Engineering	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
8	18 CS 40A8	Fundamentals of Information Technology	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
9	18 EC 40A9	Image Processing	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
10	18 EM 40B1	Linux Programming	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
11	18 EM 40B2	E-Commerce	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
12	18 EE 40B3	Renewable Energy Sources	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
13	18 ME 40B4	Robotics	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	

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14	18 ME 40B5	Mechatronics	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
15	18 ME 40B6	Operations Research	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
16	18 PH 40B7	Nano Materials & Technology	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
17	18 PE 40B8	Subsea Engineering	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
18	18 PE 40B9	Oil and Gas Management	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
19	18 GN 40C1	Self-Development	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
20	18 GN 40C2	Indian Culture and History	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
21	18 GN 40C3	Emotional Intelligence	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	

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22	18 GN 40C4	Professional Ethics and Values	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	
23	18 GN 40C5	Behavioral Sciences	3	0	0	3	3	NIL	EMPLOYABILITY	Practice based learning	No	

S.No	Course Code	Course Name	L	T	P	S	CR	CH	Pre-Req.	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New Course (Yes/No)	Remarks
HONOURS DEGREE COURSES													
1	18EC1101	Digital System Design	1	0	2	0	2	3	NIL	ENTREPRENEURSHIP	Case Studies based learning	No	
2	18EC1202	Computer Organization and Architecture	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
3	18EC2103	Analog Electronic Circuit Design	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
4	18EC2104	Signals and Systems	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	

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5	18EC2205	Processors and Controllers	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
6	18EC2206	Analog and Digital Communication	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	yes	
7	18EC2207	Digital Signal Processing	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
8	18EC2208	VLSI Design	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
9	18EC3109	Data Networks and Protocols	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
10	18EC4111	Wireless Communications	1	0	2	0	2	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	

S.No	Course Code	Course Name	L	T	P	S	CR	CH	Pre-Req.	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New Course (Yes/No)	Remarks
	MINOR DEGREE COURSES												

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1	18EC2206	Analog and Digital Communication	2	1	2	0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	yes	
2	18EC2207	Digital Signal Processing	2	1	2	0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
3	18EC2208	VLSI Design	2	1	2	0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	
4	18EC3109	Data Networks and Protocols	3	0	2	0	4	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
5	18EC4111	Wireless Communications	3	1	0	0	4	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No	

Percentage of Syllabus Revision = 12/84 = 14.3%

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Percentage of Courses focusing on Employability = 64/84 = 76%

Percentage of Courses focusing on Entrepreneurship = 34/84= 40%

Percentage of Courses focusing on Skill Development = 26/84 = 31%

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Y18 Course structure of M. Tech.

M.TECH - ATMOSPHERIC SCIENCE COURSE STRUCTURE

First Year (First Semester):

S. No.	Course Code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						
1	18 EC 5117	Microwave and Satellite Communications	3	1	0	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
2	18 EC 5118	Foundations of Atmospheric Science & Space Technology	3	1	0	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
3	18 EC 5119	Global Navigation Satellite System	3	1	2	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
4	18 EC 5120	Physics and Dynamics of Lower Atmosphere	3	1	2	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	

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5		Elective – 1	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
6		Elective - 2	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
7	18 IE 5149	Seminar	0	0	4	2	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
		Total	**18**	**4**	**8**	**26**					

First Year (Second Semester) :

S. No.	Course Code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						
1	18 EC 5221	Satellite Meteorology	3	1	2	5	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
2	18 EC 5222	Atmospheric & Space Instrumentation	3	1	0	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes	

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3	18 EC 5223	Advanced Satellite Navigation Systems	3	1	0	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes	
4	18 EC 5224	Weather and Climate Applications	3	1	0	4	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
5		Elective – 3	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
6		Elective - 4	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
7	18 IE 5250	Term Paper	0	0	4	2	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
		Total	**18**	**4**	**8**	**25**					

Second Year (First & Second Semester) :

S.No	Course code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						

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1	18 IE 6050	Dissertation	0	0	72	36	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP/SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes	

ELECTIVE COURSES

S.No	Course code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						
Elective-1											
1	18 EC 51I1	Atmospheric and Weather Radars	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
2	18 EC 51I2	Modern Digital Communications	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
Elective-2											
1	18 EC 51J1	GIS Analysis & Modeling	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	yes	
2	18 EC 51J2	Global Weather and Climate	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
Elective-3											
1	18 EC 52K1	Aeronomy	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	

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2	18 EC 52K2	Detection and Estimation Theory	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	Yes	
Elective-4											
1	18 EC 52L1	Weather Hazards & Risk Assessment	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	yes	
2	18 EC 52L2	Climate Change	3	0	0	3	NIL	EMPLOYABILITY/ ENTREPRENEURSHIP	Practice based learning, Problem Solving	No yes	

Percentage of Syllabus Revision = 100%
Percentage of Courses focusing on Employability = 100%
Percentage of Courses focusing on Entrepreneurship = 100%
Percentage of Courses focusing on Skill Development = 20%

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SYLLABUS

Microwave And Satellite Communications

Course Code: 18 EC 5117 **L-T-P : 3-1-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Introduction: Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications.

Orbital Mechanics: Orbital Mechanics, Look Angle determination, Orbital perturbations.
Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas.

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

Propagation Effects & their impact on Satellite – Earth Links: Introduction, Atmospheric absorption, Cloud attenuation, Tropospheric Scintillations, Ionospheric Scintillations, Rain attenuation, Rain and Ice crystal Depolarization, Propagation impairment countermeasures.

TEXT BOOKS:

1. Satellite Communications - Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications Engineering – L.Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications

REFERENCE BOOKS:

1. Satellite Communications: Design Principles - M. Richharia, BS Publications, 2nd Edition.
2. Fundamentals of Satellite Communications - K. N. Raja Rao, PHI, 2004
3. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
4. Satellite Communications - Dennis Roddy, McGraw Hill, 4th Edition, 2009.
5. Satellite Communications - Robert M Gagliardi,, DTS Publishers Ltd.
6. Communication Systems - Simon Haykin, 4th Edition, John Wiley & Sons

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Foundations of Atmospheric Science & Space Technology

Course Code :18 EC 5118 **L-T-P : 3-1-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Structure of atmosphere – Atmospheric composition, vertical thermal structure, environmental lapse rate; standard atmosphere; hydrostatic equation; Geopotential.

Thermodynamics - Thermodynamics of dry air and moist air: Equation of state for water vapour; Moisture variables, vertical stability of the atmosphere: Dry and moist adiabatic lapse rates; stability of layers.

Radiation - Solar and terrestrial Radiation: Characteristics, absorption and transmission of radiation through the atmosphere; Radiative cooling or heating of the atmosphere; Mean heat balance of the earth - atmosphere system; Atmospheric greenhouse effect.

Climate: Weather and climate concepts; World climate system: climate of the hemispheres. Global distribution of radaition, temperature, pressure, winds, precipitation; Atmospheric circulation patterns during winter and summer seasons. Jet streams. Monsoons – Asia, Australia, E. Africa and North America. Koppen and Thornthwaite climate classifications.

Electrodyanamics and radio wave propagation- Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Ground wave propagation, terrain and earth curvature effects. Tropospheric propagation; fading, diffraction and scattering; Ionospheric Propagation-refractive index, critical frequencies.

Remote Sensing: Electromagnetic (EM) energy and radiation; electromagnetic spectrum, wavelength; absorption, reflection and scattering of radiation in atmosphere, albedo, laws of radiation; active and passive remote sensing, radiation terminology; interaction between EM radiation and matter in the optical/ thermal and microwave region; spectral signatures; Spectral, spatial, temporal and radiometric resolutions. Kepler's laws of universal planetary motion, Geostationary, Sun-synchronous and special purpose orbits; visible, IR and microwave imagery, vertical sounding; Limb sounding.

Signal processing - DT Sequences and DT Systems - Analysis of LTI Systems, *Z- Transforms* and its applications; DFT and FFT Design and Realization of Digital IIR and FIR Filters:

Communications - Analog communication systems: amplitude and angle modulation and demodulation systems, Noise performance in communication systems.

TEXT BOOKS:

1. Compendium of Meteorology (WMO Pub.) - Physical Meteorology, 1973, Vol.1, No.2
2. General Climatology: by howard Critchfield. 2nd ed. Prentice-Hall, 1966
3. Fundamentals of Remote Sensing – George Joseph
4. John G Proakis, Dimtris G Manolakis, Digital Signal Processing: Principles, Algonithms and Applications, Pearson Education.

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5. R. Collin, Antennas and Radio wave Propagation, McGraw Hill, 1985. ISBN 0070118086.
6. Advanced Electronic Communications Systems, by Wayne Tomasi, 6 Edition Pearson Education.

REFERENCE BOOKS:

1. Meteorology Today - C. Donald Ahrens, Brooks Cole Pub., 2004.
2. Dynamical and Physical Meteorology - G.J.Haltiner and F.L.Martin
3. Physical Meteorology - H.G.Houghton.
4. World Climatic Systems - by John G. Lockwood, Hodder Arnold, 1985.

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Global Navigation Satellite System

Course Code :18 EC 5119 **L-T-P : 3-1-2**
Pre-requisite: NIL **Credits: 5**

Syllabus:

GNSS fundamentals: Trilateration, Hyperbolic navigation, Transit, GNSS principle of operation, Architecture, Operating frequencies, orbits, Keplerian elements.
GPS Signals: GPS and UTC Time, Signal structure, C/A and P-code, ECEF and ECI coordinate systems and WGS 84 datum, Important components of receiver and specifications.
GPS error Models: Ionospheric error, Tropospheric error, Ephemeris error, Clock errors, Satellite and receiver instrumental biases, Antenna phase center variation, multipath, estimation of Total Electron Content (TEC) using Dual Frequency measurement, Various DOP's, UERE.
GPS data processing and position fixing: RINEX navigation and observation formats, Code and Carrier phase observables, Linear combinations and derived observables, Ambiguity resolutions, Cycle slips, Position estimation.
Other satellite Navigation Systems: Galileo, GLONASS, IRNSS, Space, control and ground segments and Signal characteristics.

TEXT BOOKS:

1. Global Navigation Satellite Systems – G. S. Rao, McGraw-Hill publications, New Delhi, 2010.
2. GPS Theory and Practice - B.Hofmann Wollenhof, H.Lichtenegger, and J.Collins, Springer Wien, New York, 2000.

REFERENCE BOOKS:

1. Introduction to GPS - Ahmed El -Rabbany, Artech House, Boston, 2002.
2. Global Positioning System Signals, Measurements, and Performance - Pratap Misra and Per Enge, Ganga-Jamuna Press, Massachusetts, 2001.

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Physics And Dynamics of Lower Atmosphere

Course Code :18 EC 5120 **L-T-P : 3-1-2**
Pre-requisite: NIL **Credits: 5**

Syllabus:

Atmospheric Stability - Conditional, latent and potential instability, Stability of layers, Cloud formation, Precipitation mechanisms; Bergeron and Fendeisen process; Collision and coalescence processes.

Atmospheric motion - Inertial and Non-inertial frames- Fundamental Forces-Pressure Gradient forces, Gravitational force. Frictional force. Apparent forces - Centrifugal Force, Coriolis force. Equations of motion. Hydrostatic approximation. Balanced motion: Geostrophic Wind, Gradient Wind, Thermal wind.

Continuity equation – Horizantal divergence, Vertical motion; Circulation and Vorticity. Land and Sea breeze. Vorticity equation, barotropy and baroclinicity.

Atmospheric boundary layer (ABL) - Reynolds stresses, Laminar and Turbulent flow; Vertical subdivisions of ABL and their characteristics; Drag coefficient. Bulk aerodynamic formulae. Vertical profile of wind speed; Richardson's Number and Monin-Obukhov length.

Atmospheric Modelling - Dynamical equations for weather prediction; *Numerical methods:* Finite difference methods- forward, centered and Implicit schemes; CFL Criterion. *Numerical Models*: Quasi-Geostrophic Models: Linear and Non-linear Balance Models, Primitive Equation (PE) Models, Problem of initialization for PE models. Two Level PE Model in Momentum form; Staggered Grid Systems- Arakawa C grid, 3D General circulation models.

TEXT BOOKS:

1. Dynamical and Physical Meteorology - G.J.Haltiner and F.L.Martin
2. Compendium of Meteorology (WMO Pub.) - Physical Meteorology, 1973, Vol.1, No.2
3. Numerical Prediction and Dynamic Meteorology, G.J.Haltiner and R.T.Williams.
4. An Introduction to Dynamic Meteorology - J.R.Holton

REFERENCE BOOKS:

1. Physical Meteorology - H.G.Houghton
2. Atmospheric Thermodynamics - J.V.Iribarne and W.L.Godson
3. A first course in atmospheric radiation - G.W. Petty, Sundog Publishing
4. Meteorology Today - C. Donald Ahrens, Brooks Cole Pub., 2004.

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Atmospheric And Weather Radars

Course Code :18 EC 5111 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

Principles of Radar: Doppler radar (Transmitting and receiving aspects) scattering cross section radar equation, Doppler Shift attenuation Practical considerations. Basic system antenna arrays, TR Duplexer and transmitting systems, receiving systems coding and decoding coherent integration.

Radar signal processing: Spectral analysis of Radar signals discrete Fourier transform, power spectrum of random sequences spectral moment's extraction of structure constant velocity fields and turbulence parameters. Range ambiguities velocity ambiguities echo coherency direction of weakly scattering weather targets

Wind profilers and MST Radars: studies on clear Air turbulence (CAT) using ST / MST radar Systems Observations of structure (Cn2 and Stratified Layers) winds, waves and Turbulence parameters

TEXT BOOKS:

1. Doppler Radar & Weather Observations, R. J. Doviak, D. S. Zrnic, 2nd Edition, Dover Publications.
2. Electromagnetic waves & Radiation Systems – Edward C Jordan and Keith G.Balmain,PHI,Second Edition,India

REFERENCE BOOKS:

1. Elements of Electromagnetics - Matthew N. O. Sadiku, Oxford University Press.

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Modern Digital Communications

Course Code :18 EC 5112 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

Modern Digital Modulation Techniques: Introduction, Information Capacity, Bits, Bit Rate, Baud rate & M-ary Encoding, ASK, FSK, PSK, QAM, Bandwidth Efficiency, Carrier Recovery, Clock Recovery, DPSK, Trellis Code Modulation, Probability of Error & Bit Error Rate, Error Performance.

Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Error Rate Performance of the Decoder, Applications of DS Spread Spectrum Signals.

Frequency Hopped Spread Spectrum signals: Generation of PN Sequences, Frequency Hopped Spread Spectrum Signals, Performance of FH Spread Spectrum Signals in an AWGN Channel, CDMA System Based on FH Spread Spectrum Signals.

TEXT BOOKS:

1. Principles of communication systems-Herbert Taub, Donald L. Schilling, McGraw-Hill, 1986
2. Advanced Electronic Communications Systems - Wayne Tomasi, 6 Edition Pearson Education.
3. Digital and Analog Communication Systems - K Sam Shanmugam, John Wiley and sons (Asia) Pvt Ltd.

REFERENCE BOOKS:

1. Digital communications - Simon Haykin, John Wiley and sons, 1998
2. Advanced electronic communication systems - Wayne Tomasi, 4th Edition Pearson Education Asia, 1998
3. Modern digital and analog communication systems - B.P.Lathi, 3rd Edition, Oxford University press.
4. Digital Communications: Microwave Applications-Kamilo Feher, SciTech Publishing,1997

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GIS Analysis & Modeling

Course Code :18 EC 51J1
Pre-requisite: NIL

L-T-P : 3-0-0
Credits: 3

Syllabus:

Fundamentals of GIS: Map – scale, projection and symbolism. GIS - Introduction, definition and terminology, categories, components, fundamental operations, functional elements. Data structures, data models, GIS data acquisition, input, storage, output generation. Data preprocessing, database management, integrated analysis of spatial and attribute data.
GIS Spatial Analysis: Introduction, Defining spatial objects - point, line and area objects based on their attributes, higher level point, line and area objects.
Measurement: Measuring length of linear objects, measuring polygons, measuring shape, measuring distance. Classification – Principles, Neighborhood functions, Polygonal neighborhoods, Buffers.
Statistical Surfaces: Surface mapping, sampling the statistical surface, Digital Elevation Model (DEM). Interpolation - linear and non-linear, uses and problems. Terrain reclassification – steepness of slope, aspect, shape or form. Discrete surfaces - dot distribution maps, choropleth maps.
Spatial Arrangement: Spatial Arrangement - Point patterns, Theissen Polygons, Area patterns, Linear patterns, Directionality of Linear and Areal objects, Connectivity of Linear objects, Routing and allocation.
Overlay Analysis: Cartographic overlay, point-in-polygon and line-in-polygon operations, Polygon overlay, Automating point-in-polygon and line-in-polygon procedures in Raster, Automating Polygon overlay in Raster, Automating vector overlay, types of overlay.
Data Modelling: The state of GIS for Environmental Problem Solving, A Perspective on the State of Environmental Simulation Modeling, GIS and Environmental Modeling, The Role of Software Venders in Integrating GIS and Environmental Modeling, Cartographic Modeling, Scope of GIS and relationship to environmental modeling, data models and data quality.

TEXT BOOKS:

1. Fundamentals of GIS by MICHAEL N DEMERS. Published By john Wiley & Sons Inc.
2. Environmental Modelling with GIS, Michael F. Goodchild, Bradley O. Parks, Louis T. Steyaert.

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Global Weather and Climate

Course Code :18 EC 51J2 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

Global atmospheric circulation - Atmospheric circulation patterns. Zonally averaged meridional and zonal circulations, zonally asymmetric components of the general circulation - standing eddies and Walker circulations.

Monsoon systems - Land and sea breezes, Asian monsoons –onset, withdrawal, active and break monsoon situations. Monsoon rainfall distribution; monsoon rain bearing systems - monsoon depressions, Mid-tropospheric cyclones and Offshore vortices.

Mesoscale weather systems - CAPE and CINE, Thunderstorm, Dust storm, Hail storm, mesoscale convective system, fog, tropical cyclones, extra-tropical frontal systems.

Global and regional Circulation systems: Jet streams- Tropical Easterly jet, Subtropical Westerly jet, Somali jet over India. Easterly waves, Rossby waves and Kelvin waves.

Atmospheric –Ocean phenomena: North Atlantic Oscillation, North Pacific Oscillation, El-Nino, La Nina, Southern Oscillation, Walker circulation, Hadley circulation, Tropical Biennial Oscillation, Indian Ocean Dipole.

TEXT BOOKS:

1. Physical climatology - William D. Sellers.
2. Essentials of Meteorology – C. Donald Ahrens
3. Global Physical Climatology - Dennis L. Hartmann

REFERENCE BOOKS:

1. Dynamical and physical Meteorology - George J.Haltiner and Frank L. Martin.
2. Monsoons - P.K.Das
3. Tropical Meteorology - G.C.Asnani
4. World Climate Systems, J.G.Lockwood

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Satellite Meteorology

Course Code :18 EC 5221 **L-T-P : 3-1-2**
Pre-requisite: NIL **Credits: 5**

Syllabus:

Remote sensing for meteorology - Overview of remote sensing systems for meteorology; earth stations for remote sensing and meteorological satellites; space based measurement systems for meteorology; Active and passive remote sensing; imagery and sounding.

Radiation measurements and estimation– Mean Global Energy Balance; The First Satellite Experiment to Measure the Net Radiation; The Radiation Budget.

Radiative Transfer Equation (RTE) - Derivation of RTE; Temperature Profile Inversion; RTE in Cloudy Conditions;

Meteorological satellite systems – Series of Indian Remote Sensing Satellite, INSAT, Meteosat, NOAA, TRMM and SSMI; QuikSCAT, Oceansat2, Terra, Aqua, Megha- Tropiques satellite products.

Satellite meteorological data and products - Satellite image interpretation and enhancement techniques, cloud type identification.

Land surface temperatures from satellites; Infrared and microwave observations of sea surface temperatures (SST); Global SST retrieval algorithms from NOAA-AVHRR data.

Vegetation spectral response and vegetation indices; Normalized Difference Vegetation Index; Normalized Difference Water Index; Normalized Difference Snow Index; Normalized Difference moisture Index.

Satellite based ocean and atmospheric parameters - Satellite based rainfall estimations; cloud motion vectors; outgoing longwave radiation (OLR) and cloud top.

Active and passive sensors for ocean surface winds; soil moisture using microwave radiometer; atmospheric temperature profile retrieval; limb sounding retrieval of trace gases; GPS-RO (Global Positioning System- radio Occultation) techniques to retrieve temperature and humidity profiles.

Total Water Vapour Estimation. Determination of total Ozone and Geopotential Height. Microwave Estimation of Tropical Cyclone Intensity. Satellite measurement of Atmospheric Stability. Detection of forest fire and area estimation; Aerosol optical thickness; ISCCP; CLAVR; CO2 slicing.

TEXT BOOKS:

1. Fundamentals of Remote Sensing – George Joseph
2. Satellite Meteorology: An introduction - S.Q. Kidder and T.H. Vonder Haar
3. Lecture Notes for Post Graduate Course on Satellite Meteorology and Global Climate, Vols.1, 2 and 3. ISRO Publications.

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4. Applications with Meteorological Satellites - W. Paul Menzel, Technical document, WMO/TD No. 1078.

REFERENCE BOOKS:

1. The use of satellite data in rainfall monitoring- E.C. Barrett and W. N. Martin
2. Remote sensing of atmosphere - J.T. Houghton, F.W. Taylor and C.D. Rodgers.
3. Satellite Meteorology - R.R. Kelkar, B.S.Publications.

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Atmospheric & Space Instrumentation

Course Code :18 EC 5222 **L-T-P : 3-1-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Observational Techniques of atmospheric parameters – Measurement of temperature:

Electrical Resistance thermometers, Semiconductor thermometers, Bimetallic thermometers, Thermocouples.

Measurement of Atmospheric Pressure – Mercury, Aneroid & Piezo – resistive barometers.
Measurement of Humidity- Psychrometer, Hygrometer
Measurement of Surface wind - Wind vane, Cup anemometer, Hotwire Anemometer, Sonic Anemometer.

Radiosonde & Rawin measurement sensors
Measurement of Precipitation – Recording & Non-recording precipitation gauges.
Measurement of Radiation - Pyrheliometer, Pyranometer, Net Radiometer, Pyrgeometer
Radar principles and technology - propagation, scattering and attenuation of microwaves in the lower atmosphere, weather radar signal processing and display, Weather Radar: Signal Processing and display, Phenomena observed, operational weather Radar.

Radar Measurements -Observation and estimation of precipitating systems, radar equation for precipitation targets. Doppler radar – Velocity measurements, Radar wind profiler – MST Radar, Lidar & Sodar, Observation of Tropical Cyclones, use of weather Radar in Aviation, observation of clear air turbulence.

Satellite Sensors - Advance very high resolution radiometer, very high resolution radiometer, visible and infrared spin scan Radiometer, Atmospheric sounder – VAS, special sensor microwave imager – SSM/I, High resolution infrared Radiation sounder – HIRS, microwave sounding unit-MSU, Scatterometer, Synthetic Aperture Radar, Altimeter, Ocean Colour Monitor-OCM.

TEXT BOOKS:

1. Radar Meteorology - Henry Sauvageot, Artech House, 1992.
2. Satellite Meteorology – An Introduction, Stanely Q Kidder, Thomas H VanderHaus, Academic Press Inc.
3. Guide to Meteorological Instruments and Methods of Observation. WMO-No. 8, World Meteorological Organization, 2008.

REFERENCE BOOKS:

1. Radar Meteorology – S. Raghavan, Kluwer Academic Publishers, 2003
2. Weather Radar: Principles and Advanced Applications, Peter Meischner, Springer -Verlag.

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Advanced Satellite Navigation Systems

Course Code :18 EC 5223 **L-T-P : 3-1-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Differential GPS systems: Introduction to Differential GPS systems, LADGPS, WADGPS, Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS, Local Area Augmentation system (LAAS).
Inertial Navigation Systems: Introduction to Inertial Navigation, Inertial sensors, Navigation Coordinates, System implementations, System-level error Models.
GPS/INS Integration: GPS receiver performance issues, inertial sensor performance issues, Kalman filter, GPS-INS integration methods.
GPS receivers: Signal Conditioning, Signal acquisition and carrier and code tracking.

TEXT BOOKS:

1. Understanding GPS Principles and Applications - E.Kaplan Artech House, 1996, ISBN 0890067937.
2. Global Positioning Systems, Inertial Navigation, and Integration - Mohinder S. Grewal, California State University at Fullerton, A John Wiley & Sons, Inc. Publication.

REFERENCE BOOKS:

1. Introduction to GPS - Ahmed El -Rabbany, Artech House, Boston, 2002.
2. Global Navigation Satellite Systems – G. S. Rao, McGraw-Hill publications, New Delhi, 2010.
3. GPS Theory and Practice - B.Hofmann Wollenhof, H.Lichtenegger, and J .Collins, Springer Wien, New York, 2000.

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Weather And Climate Applications

Course Code :18 EC 5224 **L-T-P : 3-1-0**
Pre-requisite: NIL **Credits: 4**

Syllabus:

Weather and climate data - Sources for local, regional and global meteorological data; data from national and international sources; spatial and temporal resolution of data; Observational and model generated data.

Applications to hydrology – Rainfall: interception and infiltration, surface runoff and sub-surface run-flow. Rainfall-Runoff models, Flood forecasting. Drought categories and assessment techniques. Effects of urbanization on climate and stream flow. Urban hydrology modeling and risk assessment.

Applications to air quality - Sources and classification of atmospheric pollutants, Factors affecting atmospheric pollution. Atmospheric pollution at local, urban, regional, continental and global scales. Air quality standards and legislation.

Transport and dispersion of atmospheric pollutants: estimation of pollutants. Application of weather data for air quality assessment using models. Effects of atmospheric pollution on human health, animals, vegetation, materials and property. Air quality risk assessment.

Applications to agriculture - Relationship between weather and agriculture; climatic requirements of common agricultural crops, Plant phenology; effect of weather factors on the growth and development of plants; Weather factors conducive to infection; crop protection from adverse meteorological phenomena-droughts, heavy rains, storms, cold waves and frost, heat waves, strong winds.

Crop-weather calendars; statistical analysis of crop and weather data; Agro-meteorological forecasting: basic principles, phenological forecasting, crop-yield forecasting, weather forecast and warning for agriculture. Principles of weather prediction for crops with special reference to India.

TEXT BOOKS:

1. Hydrometeorology - C.J.Wiesner
2. Guide to Agricultural Meteorological Practices: WMO No.134, 1981.
3. Agroclimatic/Agrometeorological Techniques, S.Jeevananda Reddy, Jeevan Charitable Trust, ICRISAT Colony, Secunderabad, 1993

REFERENCE BOOKS:

1. Physico, Chemical aspects of Air pollution - Henry.C Perkins.
2. Hand book of Applied meteorology – David D. Houghton (John Wiley & Sons, 1985)
3. Atmosphere, Weather and Climate - Barry and Chorley (Routledge Publ., 2009)

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Aeronomy

Course Code :18 EC 52K1 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

Neutral Atmosphere: Structures and Composition: Nomenclature- Thermal structure of the atmosphere. Hydrostatic equation of the atmosphere structure. Scale height and geopotential height and geopotential height. Exosphere.

Chemical concepts in Atmosphere: Thermodynamic considerations- Enthalpy. Elements chemical kinetics- Reaction rate constants and chemical life time of spieces. Unimolecular, biomolecular and termoecular reactions. Effect of dynamics on chemical species.

Ionoized atmosphere: Photochemical processes in the ionosphere? Introduction to ionosphere-discovery. Continuity equation and photochemical equilibrium. Theory of photo- ionization and Chapman production function. Chemical recombination and electron density. Solar radiation and production of ionospheric layers.

Loss process in D, E and F regions: different types of recombination processes. Chemistry of D,E and F regions. D region balance equations. D region chemistry –formation of water cluster ions. Electron attachment and negative ions, Linear and square law loss formulae and splitting of F layer. Vertical transport, ambipolar diffusion.

Morphology: Spatial and temporal structure of the ionosphere- Diurnal, seasonal and solar cycle variations of D, E and F regions and F region anomalies. Space weather disturbances, Sudden Ionospheric Disturbances (SIDs), magnetic storm effects.

TEXT BOOKS:

1. Introduction to Ionospheric Physics - H. Rishbeth and O.K Garriott
2. Upper Atmosphere and Solar Terrestrial Relations - J.K. Hargreaves

REFERENCE BOOKS:

1. An Introduction to the Ionosphere and Magnetosphere. John Ashworth Ratcliffe,1972.

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2. Statistical Signal Processing Modell

Weather Hazards & Risk Assessment

Course Code :18 EC 52L1 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

Weather hazards: Types of weather hazards, vulnerability to weather elements, tropical cyclones, severe local storms, heavy precipitation, flash floods, fog, heat and cold waves, tornadoes.

GIS based Modelling -Hydrological Modeling - water quality modeling, watershed management and modeling, saltwater intrusion models. Land-surface-subsurface Process Modeling - pipeline alignment studies, solid and hazardous waste disposal site selection, zoning atlas for industrial silting, environmental information system development. Ecosystem modeling, risk and hazard modelling.

Disaster Impact and Damage Analysis: The use of satellite imagery for disaster relief and recovery; Impact analysis and preliminary damage assessment.

Pre-Disaster Risk Assessment: Hazard Assessment; Elements at risk and vulnerability assessment; Types and methods of risk assessment, risk evaluation, cost-benefit analysis.

Risk Information for Risk Reduction Planning: Risk evaluation, Visualization of risk information; Risk information and spatial planning.

TEXT BOOKS:

1. Weather Risk Management: A guide for Corporations, Hedge Funds and Investors - Tang, K., Ed., Risk Books, 2010.
2. The transfer of weather risk faced with the challenges of the future - Finas, B., SCOR, 2012.
3. Climate Risk and the Weather Market: Financial Risk Management with Weather - Hedges, Robert S. Dischel Ed., Risk Books, 2002.
4. Weather Derivatives: Modeling and Pricing Weather-Related Risk - Antonis Alexandridis K. and Achilleas D. Zapranis , Springer, 2012.

REFERENCE BOOKS:

1. Climate risk assessment and management in agriculture - Ramasamy Selvaraju; http://www.fao.org/docrep/017/i3084e/i3084e06.pdf
2. Severe and hazardous weather: An introduction to high impact meteorology - Rauber Robert M, Walsh John E, Charlevoix Donna J, Kendall Hunt Publishing, 2013.

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Detection And Estimation Theory

Course Code :18 EC 52K2 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

Random - Discrete-time signals: Review of probability, Random data, Generation of Pseudo-random noise, Filtered signals, Autocorrelation and power spectral density, Sampling band-Limited random.

Detection of signals in noise:- Minimum probability of Error Criterion, Neyman-Person criterion for Radar detection of constant and variable amplitude signals, Matched filters, Optimum formulation, Detection of Random signals.

Estimation of signals in noise: Linear mean squared estimation, Non linear estimates, MAP and ML estimates, Maximum likelihood estimate of parameters of linear system, Simple problems thereon.

Recursive linear mean squared Estimation: Estimation of a signal parameter, Estimation of time-varying signals, Kalman filtering, Filtering signals in noise,

Case studies related to estimation and detection processes.

TEXT BOOKS:

1. Signal processing: Discrete Spectral analysis, Detection and Estimation - Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.
2. Signal Detection and Estimation - Mourad Barkat, Artech House Inc, , 2nd edition, Norwood, MA 02062, 2005,
3. Fundamentals of Statistical Signal Processing: Estimation Theory - Steven M. Kay, Prentice Hall New Jersey, 1993

REFERENCE BOOKS:

1. Probability, Random Variables and Random Signal Principles - Peyton Z.Peebles Jr, 4th Edition, Tata Mc Graw Hill.
2. Lessons in Estimation Theory for Signal Processing, Communication and Control - Jerry M. Mendel, Prentice Hall Inc., 1995.
3. Detection of signals in Noise and Estimation - Shanmugam and Breipohl, John Wiley & Sons, New York, 1985.
4. Intuitive Probability and Random Processes using Matlab - Steven M. Kay, Springer, 2006.

SIMULATION TEXT BOOKS:

1. Statistical Digital Signal Processing and Modeling - Monson Hayes, John Wiley & Sons.

3. Meteorology Today - C. Donald Ahrens, Brooks Cole Pub., 2004.

Climate Change

Course Code :18 EC 52L2 **L-T-P : 3-0-0**
Pre-requisite: NIL **Credits: 3**

Syllabus:

The Climate system – energy balance of the earth-atmosphere. History of climate change – glacial cycle, inter-glacial and insterstadial events, year to decadal variations, natural variability. **Global warming** – Anthropogenic climate change. Greenhouse gases (GHG) and global warming – GHGs trend, global temperature trend, global distribution of emissions, Sources of CO_2 in the Land, Ocean and atmosphere.

Future Emissions and Energy Resources, Current and Future sources of Methane, Biological sources of Nitrous oxide, societal resilience. Mitigation strategies: Reducing Carbon Emissions, Energy use and Emission trading,

Climate trends: Teleconnections of the world climate system, consequences of global warming; Ozone hole; Volcanic eruptions and aerosols, Nuclear winter; Climate in relation to sunspot and cosmic activity.

IPCC Assessment of climate change: Detection and Attribution of Climate Change: from Global to Regional scales. Short term climate change: Projections and Predictability. Long-term climate change: Projections, commitments and irreversibility. Climate phenomena and their relevance for future regional climate change.

The measurement of climate change. Climate change and extreme weather events. Climate change impacts on ecosystems, agriculture.

TEXT BOOKS:

1. Earth's Climate: Past and Future - Ruddiman, William F.2001.
2. Climate Change 2001 - Houghton, J.T., 2001, (ed). The Scientific Basis. 881pp.
3. Climate Change: A Multidisciplinary Approach - William James Burroughs
4. Current trends in Global Environment - A.L. Bhatia (2005).

REFERENCE BOOKS:

1. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC 2013 report. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
2. Causes of Climate - J.G.Lockwood

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M.TECH – VLSI COURSE STRUCTURE

First Year (First Semester):

S. No.	Course Code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						
1	18 EC 5128	MOS Circuit Design	3	1	2	5	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
2	18 EC 5129	Algorithm for VLSI Design Automation	3	1	0	4	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
3	18 EC 5130	HDL & PLD Architectures	3	1	2	5	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	

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4	18 EC 5131	IC Fabrication Technology	3	1	0	4	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	YES	Recommendations from industry professionals for skill development and employment opportunities.
5		Elective – 1	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
6		Elective - 2	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
7	18 IE 5149	Seminar	0	0	4	2	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
		Total	**18**	**4**	**8**	**24**					

First Year (Second Semester) :

S. No.	Course Code	Course Title	Periods	Credits	Pre-Req	Activities / Content with direct bearing on	Course Category	New course (Yes/No)	Remarks

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			L	T	P			**Employability / Entrepreneurship/ Skill development**			
1	18 EC 5232	Advanced Analog IC Design	3	1	2	5	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
2	18 EC 5233	Low Power VLSI Circuits	3	0	2	4	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
3	18 EC 5234	VLSI System Design	3	1	0	4	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
4	18 EC 5235	Testing of VLSI Circuits	3	1	0	4	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
5		Elective – 3	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	

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6		Elective - 4	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
7	18 IE 5250	Term Paper	0	0	4	2	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
		Total	**18**	**4**	**8**	**24**					

Second Year (First & Second Semester) :

S.No	Course code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						
1	18 IE 6050	Dissertation	0	0	72	36	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	

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ELECTIVE COURSES

S.No	Course code	Course Title	Periods			Credits	Pre-Req	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New course (Yes/No)	Remarks
			L	T	P						
Elective-1											
1	18 EC 51Q1	Embedded System Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
2	18 EC 51Q2	VLSI Signal Processing	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
3	18 EC 51Q3	CMOS Mixed Signal Circuits	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
4	18 EC 51Q4	Nano Electronics	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning,	No	

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									Problem Solving		
5	18 EC51Q5	CAD Tools for VLSI	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
Elective-2											
1	18 EC 51R1	Image and Video Processing	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
2	18 EC 51R2	Bi-CMOS Technology & Applications	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
3	18 EC 51R3	Semiconductor Device Modeling	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
4	18 EC 51R4	Memory Design and Testing	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	

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5	18 EC 51R5	Reconfigurable Computing	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
Elective-3											
1	18 EC 52S1	System on Chip Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
2	18 EC 52S2	Process and Device Characterization Measurements	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
3	18 EC 52S3	Advanced VLSI Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
4	18 EC 52S4	MEMS System Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	

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5	18 EC 52S5	VLSI for Wireless Communication	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
Elective-4											
1	18 EC 52T1	Optimization Techniques and Applications in VLSI Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
2	18 EC 52O1	CMOS RF Circuit Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
3	18 EC 52T2	Advanced Digital IC Design	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
4	18 EC 52T3	Nano Sensors and its applications	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning, Problem Solving	No	
5	18 EC 52T4	ASIC Design Flow	3	0	0	3	NIL	EMPLOYABILITY / SKILL DEVELOPMENT	Practice based learning,	No	

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									Problem Solving		

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Annexure IV

Revised and New Coursesfor B. Tech

Course Code	Name of the Course	Semester	LTPS	Credits	Pre-req.	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New courses (Yes/No)	Remarks
18EC2103	Analog Electronic Circuit Design	ODD	3-0-2-0	4	NIL	EMPLOYABILITY, SKILL DEVELOPMENT	Practice based learning, Problem Solving	YES	Syllabus change
18EC2205	Embedded Controllers	ODD	2-0-3-2	4	NIL	EMPLOYABILITY	Practice based learning	YES	Syllabus change
18EC2206	Analog and Digital Communication	ODD	3-0-3-0	4.5	NIL	EMPLOYABILITY	Practice based learning	YES	Syllabus change
18EC3109	Data Networks & Protocols	ODD	3-0-2-0	4	NIL	EMPLOYABILITY	Practice based learning	YES	Syllabus change
18EC2112	Electromagnetic Fields & Applications	ODD	3-1-0-0	4	NIL	EMPLOYABILITY, SKILL DEVELOPMENT	Practice based learning, Problem Solving, Case study	Yes	New course

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18EC4084	Electronic Instruments & Biomedical Applications	EVEN	3-0-0-2	3.5	NIL	SKILL DEVELOPMENT	Practice based learning, Problem Solving	Yes	New course
18SC1207	Technical Skill - 2 (Coding)	EVEN	0-0-0-6	1.5	NIL	SKILL DEVELOPMENT	Experimental Learning	Yes	New Course
18EC5131	IC Fabrication Technology	EVEN	3-1-0-0	4	NIL	EMPLOYABILITY, ENTREPRENEURSHIP	Problem based learning, Case study	Yes	New course for M. TECH VLSI

Revised and New Courses for M. Tech

Course Code	Name of the Course	Semester	LTPS	Credits	Pre-req.	Activities / Content with direct bearing on Employability / Entrepreneurship/ Skill development	Course Category	New courses (Yes/No)	Remarks
18EC5131	IC Fabrication Technology	EVEN	3-1-0-0	4	NIL	EMPLOYABILITY, ENTREPRENEURSHIP	Problem based learning, Case study	Yes	New course for M. TECH VLSI

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Syllabus Revision for B. Tech.

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
18EC2103	Analog Electronic Circuit Design	Practice based learning, Problem Solving	3	0	2	0	4	NIL	Revised	Academic Peers	The proposed modifications also emphasize interdisciplinary integration, acknowledging the increasing interconnectedness of analog electronic circuit design with other engineering disciplines. Lastly, considerations for accessibility and inclusivity cater to diverse learning styles and needs, fostering a more inclusive educational environment. The modification, therefore, seeks to enhance the course's overall quality and relevance.
18EC2205	Embedded Controllers	Practice based learning	2	0	3	2	4	NIL	Revised	Student	The modification of the syllabus for the Embedded Controllers course is justified to enhance the overall learning experience and relevance of the content to current industry trends. In the rapidly evolving field of embedded systems, it is imperative to align

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											the course curriculum with the latest technological advancements, emerging standards, and industry demands.
18EC2206	Analog and Digital Communication	Practice based learning	3	0	3	0	4.5	NIL	New	Academic Peers	The introduction of a new course in Analog and Digital Communication is essential to address the evolving landscape of communication technologies and to equip students with the skills necessary for the modern workforce. As communication technologies continue to advance at a rapid pace, the integration of both analog and digital communication principles becomes crucial for understanding and navigating this complex domain.
18EC3109	Data Networks & Protocols	Practice based learning	3	0	2	0	4	NIL	Revised	Alumni	The modification aims to incorporate the latest advancements, emerging technologies, and industry best practices, providing students with a comprehensive understanding of contemporary networking concepts and protocols.
18EC2112	Electromagnetic Fields & Applications	Practice based learning, Problem Solving, Case study	3	1	0	0	4	NIL	Revised	Industry Personnel	The modification of the Electromagnetic Fields & Applications course syllabus is imperative to enhance the relevance and effectiveness of the curriculum in light of evolving technological advancements and industry requirements. In the rapidly changing landscape of electromagnetic fields,

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											emerging technologies such as 5G, IoT, and electric vehicles demand a more comprehensive understanding of electromagnetic principles.
18EC4084	Electronic Instruments & Biomedical Applications	Practice based learning, Probem Solving	3	0	0	2	3.5	NIL	New	Alumni	In today's technological landscape, electronic instruments play a pivotal role in advancing healthcare by facilitating accurate diagnostics, monitoring, and treatment. This course aims to bridge the gap between electronics and biomedical applications, equipping students with specialized knowledge in designing, developing, and implementing electronic instruments for medical purposes. With a focus on cutting-edge technologies such as medical sensors, imaging devices, and wearable health monitoring systems, the course will empower students to contribute to the rapidly evolving field of biomedical engineering.
18EC3021	Advance course in soft computing	Practice based learning, Problem Solving	3	0	2	0	3	NIL	New	Alumni	The introduction of the Advanced Course in Soft-Computing is a strategic response to the growing demand for professionals skilled in the interdisciplinary field of soft computing. As technology continues to advance, the integration of artificial intelligence, machine learning, and fuzzy logic has become increasingly prevalent in various industries.

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											This course aims to fill a critical gap in the education landscape by offering a specialized program that delves into advanced concepts and applications within soft computing.
18EC3051	Wireless Sensor Networks & IOT Applications	Practice based learning, Probem Solving	3	0	0	0	3	NIL	New	Faculty	This course will equip students with a profound understanding of the underlying principles, protocols, and technologies governing wireless sensor networks, as well as the practical skills to develop and deploy IoT applications. By bridging theoretical concepts with hands-on experiences, the course not only addresses the current industry demand for IoT expertise but also ensures that students are well-prepared to contribute to the ongoing technological advancements and innovations in this rapidly evolving field.
18EC3071	Control systems and Introduction to Robotics	Practice based learning, Problem Solving	3	0	0	2	3.5	NIL	New	Industry Personnel	As industries increasingly embrace automation and robotics to enhance efficiency and productivity, there is a pressing need for engineers well-versed in the principles of control systems and the fundamentals of robotics. This course fills a critical gap in our curriculum by providing students with a comprehensive understanding of control theory, system dynamics, and the practical application of these concepts in the field of robotics.

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18EC3092	4G Wireless Technologies & Cellular Communications	Practice based learning, Problem Solving	3	0	0	0	3	NIL	New	Industry Personnel	With the relentless evolution of communication networks, there is an increasing demand for professionals well-versed in the intricacies of 4G wireless technologies and cellular communications. This course aims to bridge the knowledge gap by offering students a comprehensive understanding of the advanced principles, protocols, and architectures that underpin 4G networks. The integration of topics such as LTE (Long-Term Evolution), WiMAX, and advanced cellular communication protocols will empower students to navigate the complexities of modern wireless systems.
18EC5131	IC Fabrication Technology	Practice based learning, Problem Solving	3	1	0	0	4	NIL	New	Industry Personnel	This course addresses a critical gap in our curriculum, enabling students to gain comprehensive insights into the intricacies of IC fabrication. By covering topics such as cleanroom protocols, photolithography, deposition techniques, and etching processes, students will acquire practical skills essential for designing and producing semiconductor devices.

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Course wise Syllabus revision of approved structure as mentioned in point 1(Program structure (with all Courses) containing following categorization).

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
18EC2103	Analog Electronic Circuit Design	Practice based learning, Problem Solving	**Syllabus: Diodes:** Concepts of diode as a switching element, diode as Limiter, design of: Clipper, half wave & full wave rectifier, Clamper, Voltage multiplier, Capacitor filters, Concepts of Regulators: Series and shunt voltage regulator, Zener diode, Design of Zener diode regulator, **Transistors:** Concepts of amplifier, Q point, load line analysis, Biasing of BJT, Self-Bias-CE, High and low frequency –small signal models of Transistors, Expression of voltage gain, current gain, input & output impedance, Designing CE	**Syllabus: Diodes:** Concepts of diode as a switching element, diode as Limiter, design of: Clipper, half wave & full wave rectifier, Clamper, Voltage multiplier, Capacitor filters, Concepts of Regulators: Series and shunt voltage regulator, Zener diode, Design of Zener diode regulator, Concept of junction capacitance, Varactor diode, LED. **Transistors:** Concepts of amplifier, Q point, load line analysis, Biasing of BJT, Self-Bias-CE, High and low frequency –small signal models of Transistors, Expression of voltage gain, current gain,	**Topics added:** **CO1:** Concept of junction capacitance, Varactor diode, LED. **CO2:**Concept of Feedback, Feedback amplifier configurations, Emitter follower **CO3:**Filter Circuits: Design and Analysis of Low pass, High pass, Bandpass, Band reject filters	CO1, CO2,CO3 are modified	Professional core course helps better employment	**60%**

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
			amplifier, FET fundamentals, Configurations, current-voltage characteristics, Biasing of JFET, Biasing of MOSFET FET small signal model, Design and analysis of RC coupled amplifier. **Op-amps:** Ideal OPAMP, Concept of differential amplifier, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower, Adder, Design and analysis of Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier. filters **Design and analysis of Oscillators:** Barkhausen	input & output impedance, Designing CE amplifier, FET fundamentals, Configurations, current-voltage characteristics, Biasing of JFET, Biasing of MOSFET FET small signal model, Design and analysis of RC coupled amplifier, Concept of Feedback, Feedback amplifier configurations, Emitter follower. **Op-amps:** Ideal OPAMP, Concept of differential amplifier, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower, Adder, Design and analysis of Integrator & Differentiator,				

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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
			criterion, Colpitt, Hartley's, RC Phase shift, Wien bridge, & Crystal oscillators. **555 applications:** Design and analysis of Monostable & Astable multi vibrators using 555 and their applications.	Comparator, Schmitt Trigger, Instrumentation Amplifier. Filter Circuits: Design and Analysis of Low pass, High pass, Bandpass, Band reject filters **Design and analysis ofOscillators:** Barkhausen criterion, Colpitt, Hartley's, RC Phase shift, Wien bridge, & Crystal oscillators. **555 applications:** Design and analysis of Monostable & Astable multi vibrators using 555 and their applications.				
18EC2205	Embedded Controllers	Practice based learning	CO1: Basics of Embedded System: Basics, Introduction and History of Processors, 8086 Architecture, Instruction set, 8086 programming and	CO1: Basics of Embedded System: Basics, Introduction and History of Processors, 8086 Architecture, Instruction set, 8086 programming and	**CO2:** Simple Programs involving Arithmetic and Logical Instructions, Timers/Counters, Interrupts. CO3: Advanced Microcontroller Bus Architecture (AMBA). CO4:	CO2, CO3, CO4 are modified	Professional core course helps better employment	**50%**

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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
			examples. 5 Hrs CO2: Microcontroller Fundamentals: 8051 Architecture, addressing modes, Instruction set,10 Hrs. CO3: Serial Data Communication and RS-232C Standard with 8051 Programming, Peripherals and Input Output with 8051Microcontroller(PIO, Timers and Interfacing) Modern Microcontrollers: Introduction and Architecture of PIC Microcontroller, Introduction of ARM7 (LPC2148), Basic Architecture of ARM7, Pin Description, 11 Hrs CO4: Advanced Topics: Introduction to CORTEX (STM 32), Architecture and Introduction to RTOS (Real Time operating systems). 4 Hrs	examples. 5 Hrs CO2: Microcontroller Fundamentals: 8051 Architecture, addressing modes, Instruction set, Simple Programs involving Arithmetic and Logical Instructions, Timers/Counters, Interrupts. 10 Hrs. CO3: Serial Data Communication and RS-232C Standard with 8051 Programming, Peripherals and Input Output with 8051Microcontroller(PIO, Timers and Interfacing) Modern Microcontrollers: Introduction and Architecture of PIC Microcontroller, Introduction of ARM7 (LPC2148), Basic Architecture of ARM7, Pin Description, Advanced	Basic concepts and applications of RTOS			

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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
				Microcontroller Bus Architecture (AMBA).11 Hrs CO4: Advanced Topics: Introduction to CORTEX (STM 32), Architecture and Introduction to RTOS (Real Time operating systems). Basic concepts and applications of RTOS. 4 Hrs				
18EC2206	Analog and Digital Communication	Practice based learning	CO:1 Fundamentals of Analog Communications Introduction Modulation types: AM, FM, Pulse Mod, SNR, Bandwidth, Power Spectrum. (a) AM Concept : DSB-SC, SSB, Coherent detection, Modulation Index. (b) FM Concept: Modulation Index of FM and Phase Modulation (c) Pulse Mod. Concept: Sampling, PAM, PWM, PPM : Modulation and	CO:1 Fundamentals of Analog Communications Introduction Modulation types: AM, FM, Pulse Mod, SNR, Bandwidth, Power Spectrum. (a) AM Concept : DSB-SC, SSB, Coherent detection, Modulation Index. (b) FM Concept: Modulation Index of FM and Phase Modulation (c) Pulse Mod. Concept: Sampling, PAM, PWM, PPM : Modulation and	**CO2:** Vocoders: LPC, CELP, RPE-LTP; Related Problems CO3: Telecommunication Systems: circuit switching, T1/E1, SS7 signalling, PDH and SDH, DSL/ADSL,PSTN Switching CO4: Data Communication Systems: Packet Switching, PAN, LAN, WAN, MAN, Internetworking, VoIP.	CO2, CO3, CO4 are modified	Professional core course helps better employment	**50%**

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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
			Demodulation (d) Transceiver: Super Heterodyne Receiver (e) Noise and types of noise; Related Problems CO2: Digital Communication Basics (a) PCM: Quantization noise, SQNR, SNR vs Bandwidth; (b) DPCM, DM, ADM coders. CO3: Introduction to Digital Carrier Systems, Switching and Signalling (a) ASK, PSK, FSK, QPSK, QAM, MSK, bandwidth consideration. (b) RZ, NRZ, Bipolar RZ AMI, Manchester, HDB3 and B8ZS and circuit implementations, Bits and Bauds. CO:4 Modern Communication Methods Multiplexing and Multi access, FDMA, TDMA, CDMA, CSMA;	Demodulation (d) Transceiver: Super Heterodyne Receiver (e) Noise and types of noise; Related Problems CO2: Digital Communication Basics (a) PCM: Quantization noise, SQNR, SNR vs Bandwidth; (b) DPCM, DM, ADM coders. (c)Vocoders: LPC, CELP, RPE-LTP; Related Problems CO3: Introduction to Digital Carrier Systems, Switching and Signalling (a) ASK, PSK, FSK, QPSK, QAM, MSK, bandwidth consideration. (b) RZ, NRZ, Bipolar RZ AMI, Manchester, HDB3 and B8ZS and circuit implementations, Bits and Bauds. (c) Telecommunication				

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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
			OFDMA, Rake Receiver, Spread spectrum Techniques.	Systems: circuit switching, T1/E1, SS7 signalling, PDH and SDH, DSL/ADSL,PSTN Switching. CO:4 Modern Communication Methods (a) Multiplexing and Multi access, FDMA, TDMA, CDMA, CSMA; OFDMA, Rake Receiver, Spread spectrum Techniques. (b) Data Communication Systems: Packet Switching, PAN, LAN, WAN, MAN, Internetworking, VoIP.				
18EC3109	Data Networks & Protocols	Practice based learning	CO-1: Introduction to Computer networks and Data Link Layer: Introduction to Computer networks Use of Computer Networks, Network Hardware, Network software, Reference models: OSI and TCP/IP, Example	CO-1: Introduction to Computer networks and Data Link Layer: Introduction to Computer networks Use of Computer Networks, Network Hardware, Network software, Reference models: OSI and TCP/IP, Example	**CO1:** Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet. CO2: Access Control list for IPV4, IPV6, Other Protocols: NAT, ARP, Port Address Translation (PAT), IP Tunneling; DHCP CO4: Network Security: Essential	CO1, CO2, CO4 are modified	Professional elective course helps better employment	**50%**

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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
			Networks, Physical Layer: The theoretical basis for Data Communication, Guided and Unguided Transmission Media, Switching, Modems, ADSL, Trunks and Multiplexing. Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. CO-2:Network layer and Internetworking Internetworking Devices: Preamble to Network Layer, Distinguishing of Networking Devices and Internetworking Devices, Analysis of Router Processing: Access, core and distribution. VLANS, Ehternet Internetworking Technologies: Wired	Networks, Physical Layer: The theoretical basis for Data Communication, Guided and Unguided Transmission Media, Switching, Modems, ADSL, Trunks and Multiplexing. Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet. CO-2:Network layer and Internetworking Internetworking Devices: Preamble to Network Layer, Distinguishing of Networking Devices and Internetworking Devices,	Steps for Configuring a New Server and firewalls, Different types of network layer attacks and IP security.			

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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
			Router, Wireless Router, Gateway, CSU/DSU; Addressing: IP addressing (IPV4 & IPV6), subnetting; Types of Routing: static, default and dynamic. Networking Protocols: RIP, OSPF, BGP; CO-3:Transport layer, Session Layer, Presentation Layer and Application Layer: Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fibre Channel Protocol; Stream Control Transmission Protocol (SCTP); Congestion Control: Open Loop, Closed Loop Choke Packets; Quality of Service: Techniques to Improve QoS: Leaky bucket algorithm, Token bucket algorithm. Session Layer: ISNS Internet	Analysis of Router Processing: Access, core and distribution. VLANS, Ehternet Internetworking Technologies: Wired Router, Wireless Router, Gateway, CSU/DSU; Addressing: IP addressing (IPV4 & IPV6), subnetting; Types of Routing: static, default and dynamic. Networking Protocols: RIP, OSPF, BGP; Access Control list for IPV4, IPV6, Other Protocols: NAT, ARP, Port Address Translation (PAT), IP Tunneling; DHCP CO-3:Transport layer, Session Layer, Presentation Layer and Application Layer: Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fibre Channel Protocol; Stream				

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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
			Storage Name Service. Presentation Layer: SSL , preface of Socket , Secure Socket Layer Application Layer: Telnet, TFTP, POP3, DNS, SMTP, SNMP, FTP, NTP, SSDP CO-4:Advanced Topics: Cryptography: Public and Private Key based) Digital Signature , Firewalls Advancements in Application layer: ISDN services & ATM, DSL technology, wired and wireless Modem: Architecture & Operation in brief. Wireless LANs: IEEE 802.11; Multi-Band Routers (Tri Band Wireless Routers);	Control Transmission Protocol (SCTP); Congestion Control: Open Loop, Closed Loop Choke Packets; Quality of Service: Techniques to Improve QoS: Leaky bucket algorithm, Token bucket algorithm. Session Layer: ISNS Internet Storage Name Service. Presentation Layer: SSL , preface of Socket , Secure Socket Layer Application Layer: Telnet, TFTP, POP3, DNS, SMTP, SNMP, FTP, NTP, SSDP CO-4:Advanced Topics: Cryptography: Public and Private Key based) Digital Signature , Firewalls Advancements in Application layer: ISDN services & ATM, DSL technology, wired and wireless Modem:				

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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
				Architecture & Operation in brief. Wireless LANs: IEEE 802.11; Multi-Band Routers (Tri Band Wireless Routers); Network Security: Essential Steps for Configuring a New Server and firewalls, Different types of network layer attacks and IP security.				

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Syllabus for New B. Tech Courses added in AY. 2018-19

Analog Electronic Circuit Design

Course Code:18EC2103 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs)

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Analysis of BJT's and Various application in Amplifiers	PSO1,PO2	2
CO2	Understand various types of FET's, IC Types and analyse FET as an Amplifier	PO2,PSO1	2
CO3	Understand the Linear & Non-linear application of Op-AMP and Analyse active filters	PSO1,PO2	2
CO4	Analysis of different types of oscillators, filter and regulators.	PSO2,PO2	2
CO5	Design and Testing of Analog circuits for realistic applications	PSO2,PO3	3

Syllabus:

Transistor Amplifiers: BJTs: Biasing, types of biasing, h-parameters, equivalent representation of a transistor using h - parameter model, self-bias design, amplifier design from biasing, amplifier analysis using h-parameters (Gain, Bandwidth, input and output impedances), Design of a CE amplifier. Negative feedback amplifiers: need for negative feedback, feedback characteristics, 4

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topologies (quantitative analysis only), comparison of the input and output impedances of all the four topologies. Power amplifiers: concept of power amplifiers, class A class B and class AB, class C and class D power amplifiers, Distortion analysis. (Introductory level only). FETs and MOSFETs: FETs: Theory and fundamentals, classification of FETs, JFET, MOSFET, DMOS, EMOS, CMOS, VMOS (introductory level only), FET (BFW10) data sheet, CMOS ICs, difference between CMOS and TTL ICs, biasing, FET characteristics, Channel length modulation, FET amplifier and analysis (Gain, Bandwidth, input and output impedances). IC Design & Fabrication: Introduction to different types of ICs and Packaging's, IC Design and Fabrication. Operational Amplifiers: Basics: Ideal OPAMP, OPAMP characteristics, ideal and practical OPAMP, CMRR, slew rate, Virtual Ground, inverting and non inverting amplifiers. 4 Applications of OPAMPs: Adders, subtractors, scaling amplifier (using LM324 - Quad OPAMP), Integrator, Differentiator, comparator using 710 IC, Schmitt trigger, Instrumentation amplifier. Active filters: design of LP, HP, BP, BS filters (Butterworth filter, first order and 2nd order). Miscellaneous Topics: Oscillators: Function generator using LM1428, Barkhausen's criteria for sustained oscillations, Classification of oscillators, RCPS, WBO (using 741 OPAMP), Hartley and Colpitts oscillators (using transistors), crystal oscillator, 555 Timer, functional architecture of 555, Astable, monostable and bistable operation using 555. Filters: Continued LC Filters, RC Filters, RLC Filters, ripple factor for Half Wave rectifier and Full wave Rectifier. Regulators: Concept of regulation, Design of voltage regulators using LM339, IC 723, 78XX and 79XX series, SCR, Triac. TEXT BOOKS: Electronic Devices and Circuit Theory 12th Edition - Robert L. Boylestad Electronic Devices and Circuits 5th Edition – David A. Bell Linear IC Applications - RamakanthGaykwad Analog Electronic Circuit Design - V Ramani Kumar REFERENCE BOOKS: Integrated Electronics by Millman&Halkias Electronic Circuits by Schilling &Belove Digital Integrated Electronics by Taub and Schilling

Text Books : Electronic Devices and Circuit Theory 12th Edition - Robert L. Boylestad Electronic Devices and Circuits 5th Edition – David A. Bell Linear IC Applications - RamakanthGaykwad Analog Electronic Circuit Design - V Ramani Kumar

Reference Books : Integrated Electronics by Millman&Halkias Electronic Circuits by Schilling &Belove Digital Integrated Electronics by Taub and Schilling

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Web Links :http://www.nptelvideos.in/2012/11/

https://www.youtube.com/watch?v=_vKeaPHXF9U

https://www.youtube.com/watch?v=bXT7c5P9WdA

https://www.youtube.com/watch?v=LA7c7jenkd0

https://www.youtube.com/watch?v=jQb199oIY5U https://nptel.ac.in/courses/117103063/24

https://www.youtube.com/watch?v=4FFBYgnbPFk

https://www.youtube.com/watch?v=kiiA6WTCQn0

https://www.youtube.com/watch?v=k9zQjEaKtfk

https://www.youtube.com/watch?v=Gvb4GIV5ig8

https://www.youtube.com/watch?v=H8yLztt9X78

https://www.youtube.com/watch?v=x0BZeUACpK0 https://www.elprocus.com/astable-multivibrator-using-555-timer/

MOOCS :WEB REFERNCES/MOOCS: 1. https://nptel.ac.in/courses/108101091/13 2. https://nptel.ac.in/courses/122106025/6 3. https://nptel.ac.in/courses/115102014/ 4. http://www.nptelvideos.in/2012/11/basic-electronics-prof-tsnatarajan.html

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Electromagnetic Fields & Applications

Course Code: 18EC2112 L-T-P-S: 3-1-0-0

Pre-requisite: NIL Credits: 4

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the field potentials, characteristics of the behaviour of Static Electric charge and Static Magnetic charge.	PSO1,PO1,PO2	2
CO2	Understand and analyze the nature of time-varying electric and magnetic fields and wave propagation.	PSO1,PO1,PO2	2
CO3	Apply and analyze the applications of EM waves in the real-time scenarios.	PSO1,PO1,PO2	3
CO4	Apply and analyze the advanced EM wave concepts in advanced defense applications.	PO2,PSO1,PO1	3

Syllabus :CO-1: Basics: Coordinate system, Charge distributions, Coulombs law ,Electric field intensity, electric flux density, Gauss's Law, Divergence, divergence Theorem, potential and potential difference, Potential gradient, Boundary conditions on E&D. Electric current, current densities, equation of continuity. Biot-Savats Law, Ampere's circuital law, differential form of ampere's circuital law, curl, stokes's theorem. Lorentz's force equation, force on a current element in a magnetic field, Boundary conditions on B and H. Faradays law of induction. CO2: EM Waves and Propagation: Maxwell's equations in differential and integral form, wave equations for the free

space, Uniform plane wave general solution and propagation. Wave equation in conducting medium, wave equation in phasor form, wave propagation in loss less medium. CO3: Application of EM waves and Waveguides: Signalling in railways, Sensing techniques for studying biological cells, Microwave ovens, Microwave imaging methods, Telemetry, medical applications, microwave spectroscopy, Ion-Thruster for space applications, Agricultural applications and food processing. Radio wave applications in earth quake detection. CO4: Advanced Topics: Radar, Defense applications & stealth, Weather applications & millimetre radars, EMI/EMC, Nuclear magnetic resonance imaging (NMRI), Reflectivity and shielding Methods.

Text Books :1. W H.Hayt& J A Buck : "Engineering Electromagnetics" TATA McGraw-Hill, 7th Edition 2007. 2. EC.Jordan, "EM waves and Radiating Systems", International Edition, 2011 3. Mathew no Sadiku, "Elements of Electromagnetics ", Oxford University Press, 2003. 4. Simon Kingsley and Shaun Quegan, Understanding RADAR Systems, SciTech Publishing, 1999. 5. Leslie Cromwell , "Biomedical instrumentation and measurements",2nd edition

Reference Books :1. David K.Cheng: "Field and Wave Electromagnetics - Second Edition-Pearson Edition, 2004. 2. Joseph A Edminister, "Theory and problems of Electromagnetics", 2nd edition, Scham's Outline series, Mc-Graw Hill International. 3. Constantine A. Balanis," Advanced Engineering Electromagnetics" John Wiley. 4. Peter Meischner, "Weather RADAR: Principles and Advanced Applications" 5. Bruce Archambeault, et. al "EMI/ EMC Computational Modeling Handbook", 2nd Edition.

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Embedded Controllers

Course Code: 18EC2205 **L-T-P-S: 2-0-3-2**

Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the architecture and programming concepts of 8086 Microprocessor	PO1,PO2	2
CO2	Apply the Programming concepts of 8051 Microcontroller	PO5	3
CO3	Analyze the Interfacing of Peripherals to the 8051 Microcontroller through programming. Understand the basic architectures of PIC and ARM 7 microcontrollers	PO3	4
CO4	Understand the basic concepts of CORTEX STM-32 microcontroller and RTOS	PO2	2
CO5	Analyze the applications of programming with 8051 and 8086 on hardware / software. Analyze the applications of programming with Arduino & Raspberry – Pi.	PO5	4

Syllabus : CO1: Basics of Embedded System: Basics, Introduction and History of Processors, 8086 Architecture, Instruction set, 8086 programming and examples. 5 Hrs CO2: Microcontroller Fundamentals: 8051 Architecture, addressing modes, Instruction set, Simple Programs involving

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Arithmetic and Logical Instructions, Timers/Counters, Interrupts. 10 Hrs. CO3: Serial Data Communication and RS-232C Standard with 8051 Programming, Peripherals and Input Output with 8051Microcontroller(PIO, Timers and Interfacing) Modern Microcontrollers: Introduction and Architecture of PIC Microcontroller, Introduction of ARM7 (LPC2148), Basic Architecture of ARM7, Pin Description, Advanced Microcontroller Bus Architecture (AMBA).11 Hrs CO4: Advanced Topics: Introduction to CORTEX (STM 32), Architecture and Introduction to RTOS (Real Time operating systems). Basic concepts and applications of RTOS. 4 Hrs

Text Books :TEXTBOOKS: 1. Mazidi&McKinley "The 8051 Micro controller and Embedded systems: using assembles and C, 2nd edition, 2007. 2. Frank Vahid, "Embedded System Design", Wiley; Student edition (2006). 3. A K Ray and K M Bhurchandi "Advanced Microprocessors and Periperals"The McGraw Companies,2nd Edition,2006 .

Reference Books :REFERENCE BOOKS: 1. Make: Arduino Bots and Gadgets: Six Embedded Projects with Open Source Hardware and Software by TeroKarvinen, Kimmo Karvinen 2. Practical Microcontroller Engineering with ARM Technology by Ying Bai

Web Links :WEB REFERNCES/MOOCS: 1. https://www.edgefx.in/pic-microcontroller-architecture-and-applications/ 2. https://onlinecourses.nptel.ac.in/noc18_ec03/preview 3. https://www.openlearning.com/courses/microprocessors-and-embedded-systems 4. http://www.emu8086.com/assembly_language_tutorial_assembler_reference/asm_tutorial_07.html 5. http://www.atmel.in/products/microcontrollers/8051Architecture/default.aspx 6. http://www.keil.com/support/man/docs/is51/is51_instructions.htm 7. http://electrofriends.com/articles/electronics/microcontroller-electronics-articles/8051-8951/8051-microcontroller-port-programming/ 8. http://www.8051projects.net/keypad-interfacing/introduction.php 9. http://www.8051projects.net/adc-interfacing/ 10. http://www.emu8086.com/assembly_language_tutorial_assembler_reference/asm_tutorial_07.html 11. https://www.youtube.com/watch?v=fI20Bsx3EPM 12. https://www.youtube.com/watch?v=S2_KtA_6y80

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Analog and Digital Communication

Course Code: 18EC2206 **L-T-P-S: 3-0-3-0**

Pre-requisite: NIL **Credits: 4.5**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Study and apply the linear and nonlinear modulation concepts	PO1,PO2	3
CO2	Explore the basics of digital communication systems and principles	PO5	2
CO3	Learn various line coding procedures and signalling schemes to facilitate data communications.	PO2	2
CO4	Understand the concepts of multiple access and various types of networks	PO1,PO4	2
CO5	Analysis and design of Modulation and Demodulation features of various Analog & Digital Communication Systems.	PO3,PO4	4

Syllabus: CO:1 Fundamentals of Analog Communications Introduction Modulation types; AM, FM, Pulse Mod, SNR, Bandwidth, Power Spectrum. (a) AM Concept : DSB-SC, SSB, Coherent detection, Modulation Index. (b) FM Concept: Modulation Index of FM and Phase Modulation (c) Pulse Mod. Concept: Sampling, PAM, PWM, PPM : Modulation and Demodulation (d)

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Transceiver: Super Heterodyne Receiver (e) Noise and types of noise; Related Problems CO2: Digital Communication Basics (a) PCM: Quantization noise, SQNR, SNR vs Bandwidth; (b) DPCM, DM, ADM coders. (c) Vocoders: LPC, CELP, RPE-LTP; Related Problems CO3: Introduction to Digital Carrier Systems, Switching and Signalling (a) ASK, PSK, FSK, QPSK, QAM, MSK, bandwidth consideration. (b) RZ, NRZ, Bipolar RZ AMI, Manchester, HDB3 and B8ZS and circuit implementations, Bits and Bauds. (c) Telecommunication Systems: circuit switching, T1/E1, SS7 signalling, PDH and SDH, DSL/ADSL,PSTN Switching. CO:4 Modern Communication Methods (a) Multiplexing and Multi access, FDMA, TDMA, CDMA, CSMA; OFDMA, Rake Receiver, Spread spectrum Techniques. (b) Data Communication Systems: Packet Switching, PAN, LAN, WAN, MAN, Internetworking, VoIP.

Text Books :1. Simon Haykin and Michael Moher, "An Introduction to Analog and Digital Communications", 2nd Ed., Wiley, (2007). 2. Wayne Tomasi," Advanced Electronic Communication Systems", 6th Ed., Pearson Education. 3.B. Forouzan," Data Communications and Networking", 4th Ed., Mcgraw Hill. 4.W. Stallings," Data and Computer Communications",8thEd.,Pearson Education.

Reference Books :1.H Taub & Schilling, Gautam Sahe," Principles of Communication Systems", TMH, 3rd Edition, (2007). 2.R.P. Singh & S.D. Sapre," Communication Systems: Analog and Digital", Mc Graw Hill, 3 rd edition.

Web Links :1 https://onlinecourses-archive.nptel.ac.in/ 2 https://www.coursera.org/ 3 https://www.youtube.com/watch?v=qY_yg2igDjg 4 https://www.youtube.com/watch?v=bd5XkVqdWOg 5 https://youtu.be/WT1Y97riAQQ?list=PL7748E9BEC4ED83CA 6 https://www.youtube.com/watch?v=j6oB1OKjbWg 7 https://www.youtube.com/watch?v=99f2KRwVrWE 8 https://www.sciencedirect.com/science/article/abs/pii/0167639388900404 9. https://www.youtube.com/watch?v=ifgs0uypC78 10 https://www.youtube.com/watch?v=pg47dDUL1T0

MOOCS :1. https://onlinecourses-archive.nptel.ac.in/ 2. https://www.coursera.org/

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Advance Course in Soft-Computing

Course Code: 18EC3021 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 3**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the basics of Artificial intelligence and knowledge based systems.	PO1,PO2	2
CO2	To classify various patterns using ANN, different networks and applications	PO2,PO1	3
CO3	To illustrate the concepts of Machine learning, dimensionality reduction	PO1,PO2	3
CO4	To understand the concepts of Membership functions, Genetic Algorithms	PO1,PO2	2
CO5	Applications of Advanced soft computing using the programming concepts.	PO11	5

Syllabus :(i) Advanced topics in AI: BFS, DFS Search Techs (ii) Bayes Rule, Logic Progg, Knowledge Systems: Naive Bayes, Linear Regression, Logistic Regression, Objectives of KBS, Components, Categories, Knowledge Based System Architecture. Advanced topics in ANN: Nonlinear classification, Gradient Descent algorithm, Deep Learning, Deep Neural NWs: Boltzmann Machine, Recurrent Neural Networks, LSTM, Associative memories, Hopfield networks, Convolutional Neural Networks, Machine Learning: Curse of dimensionality, PCA, Linear Discrimant Analysis, extensions of LDA, clustering, k-Means algorithm, Expectation Maximization algorithm Method, Vector quantitiztion, suppot vector machine, variations in SVM, Gaussian Mixture models, applications of GMMs. Intro Other Computing Methods: Adaptive

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Fuzzy Logic: Fuzzy logic and fuzzy sets: Membership functions, operations on fuzzy sets, types of fuzzy functions, Fuzzy relationships, Genetic Algorithms: Basic Operations of a Genetic algorithm, Genetic cycles.

Text Books :1. Neural Networks and learning machines, Simon Haykin, 3e, 2016. 2. MacKay, David. Information Theory, Inference, and Learning Algorithms. Edition; Version 7.2 (fourth printing) Cambridge, UK: Cambridge University Press, 2003. 3. Karray, Fakhreddine, Fakhreddine O. Karray, and Clarence W. De Silva. Soft computing and intelligent systems design: theory, tools, and applications. Pearson Education, 2004.

Reference Books :1. Bishop, Christopher. Neural Networks for Pattern Recognition. Edition: A Clarendon Press Publication, Oxford University Press, New York, NY,1995.2. 2. S Sivanandam, Introduction to Neural Networks Using Matlab 6.0, TMH, 2017 3. Kevin Knight, "ARTIFICIAL INTELLIGENCE" Third Edition,TMH 4. 4. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd Edition, Wiley- Intercedence, New York, 2000. 5. Hastie, T., R. Tibshirani, and J. H. Friedman. The Elements of Statistical Learning: Data mining, Inference and Prediction. New York, NY: Springer, 2001. ISBN: 9780387952840. 6. B.Yagna Narayana,Artificial Neural networks, PHI, 2012

Web Links :https://www.coursera.org/specializations/machine-learning https://www.coursera.org/specializations/deep-learning? https://in.udacity.com/course/machine-learning-engineer-nanodegree--nd009t https://www.coursera.org/learn/machine-learning https://www.udemy.com/machinelearning/

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Wireless Sensor Networks & IOT Applications

Course Code: 18EC3051 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Interpret the basics of WSN, challenges and applications	PO1,PO2	3
CO2	Apply and demonstrate various WSN protocols using NS-2 simulator	PO1,PO2,PO5,PSO1	3
CO3	Analyse IoT reference architectural views and design issues of WSN	PSO1,PO1,PO2	4
CO4	Design and analyse IoT applications using simulation tool TinkerCad	PO3,PO5,PSO1,PO2	4

Syllabus : Basics of Wireless Sensor Networks: Introduction to WSN, Basic Overview of Wireless Technology, Basic Sensor Network Architectural Elements, Challenges, Applications of WSN. Some Examples of Sensor Nodes, Sensor Network Scenarios, Optimization Goals and Figures of Merit. Gateway and Router Concepts. Network Topologies: Single Hop Star, Multi Hop Mesh and Grid, Two-Tier Hierarchical Cluster. WSN Protocols and Standards: Classifications of MAC Protocols for WSN, Sensor-MAC Case Study. Routing Protocols and Strategies in WSN, WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation (Optional). ZigBee/IEEE802.15.4, IEEE 802.11/a/b/g, IEEE 802.16, Bluetooth, BLE, Infrared, Differences in range, Security, Power. Bluetooth, BLE and 6LoWPAN. IoT & Smart Cities: IoT Applications in Smart Cities, WSN for Smart Cities, WSN Design Issues for Smart Cities, Performance Metrics. Garbage Disposal, Vehicle Management, Smart Home, Smart Grid, Smart-Village. IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View IoT Applications: Healthcare, Wearables Dairy, Agriculture, Traffic Monitoring & Control, Pollution Management, Inter-Vehicular Communication, Vehicle

Tracking, Finance Transaction. Overview-- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations

Text Books :1. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007 2. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 3. Arshadeep Bahga, Vijay Madisetti, "Internet of Things, A Hands-on Approach", Universities Press Pvt. Ltd., 2015. 4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, " From Machine-to-Machine to the Internet of Things" Introduction to a New Age of Intelligence, Elsevier, 2014

Reference Books :1. B. Krishnamachari, " Networking Wireless Sensors", Cambridge University Press. 2. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier, 1st Ed. 2004 3. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed. 2004.

Web Links :1. https://www.slideshare.net/skumartarget/wsn-in-iot-61121038 2. https://www.youtube.com/watch?v=7h5Wwk_mheg

MOOCS :1. https://www.coursera.org/learn/iot-wireless-cloud-computing/home/welcome 2. https://nptel.ac.in/courses/106/105/106105160/ 3. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/ 4. https://onlinecourses.nptel.ac.in/noc19_cs65 5. https://www.betteru.in/course/wireless-sensor-networks-online-course-certificate/

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Control Systems & Introduction To Robotics

Course Code:18EC3071 **L-T-P-S: 3-0-0-2**

Pre-requisite: NIL **Credits: 3.5**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the concepts of control system	PO1	1
CO2	Study and analyse the applications of control systems in time and frequency domains	PO1	3
CO3	Understanding the basics of robotic	PO2,PO1	1
CO4	Understand and apply kinetics, dynamics and control of robots	PO1,PO2	3
CO5	Skilling	PO2	3

Syllabus : Control System Basic Concepts: Terminology, Examples, Open Loop and Closed Loop control systems, Types of control systems. Mathematical Models of physical systems: Formulation of Differential equations for Transfer Functions of DC & AC Servomotors. Block diagram of control systems; Signal flow graph, Mason's gain formula. Time and Frequency domain analysis: Standard Test signals – Step, Ramp, Parabolic and Impulse; Impulse Response, Characteristic Equation of Feedback systems, Transient Response of First order and Second order Systems, Steady state error and Error constants, Introduction to PID controllers. Stability analysis: Concept of stability and conditions for stability, Routh – Hurwitz criterion, dominant poles of transfer function. Root Locus Technique: Root Locus concept, basic properties, magnitude and angle conditions, effects of adding poles and zeros to G(s) H(s). Frequency response: Specifications, correlation, Bode plot, phase margin and gain margin; Introduction of robotics: Types of robots, Classification, usage, and the diverse Applications of Robots. Mathematical representations of robots: Position and orientations of rigid body; Homogeneous transformations, Representation of joints, Link representation using D-H

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parameters, Different kinds of Actuators (Stepper, DC servo and AC motors), Different types and Ranges of Sensors (internal and external sensors) Common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors. Kinematics, Dynamics Motion Planning and Control: Kinematics: Robotic Arm and Robots, Planning of Manipulator Trajectories, Control and Kinematics, Serial and Parallel manipulators, Direct and Inverse Kinematics. Degrees of Freedom and dynamics: Parallel mechanisms, Constraint equations, Velocity and Static Analysis, Formulation of equations of motion, Recursive Dynamics, Simulations of robots using MATLAB / PHYTHON. Robot Control techniques, Position and Force Control, Modelling and Control of Robots. Design of slip-free Wheeled Mobile robots, Advanced Topics in Robotics: Nonlinear dynamics, Chaos HMI, BMI and Humanoid.

Text Books :1. J Nagrath & M Gopal, "Control System Engineering", 5th Edition, New Age International Publication, New Delhi (2011). 2. B.C. Kuo," Automatic Control Systems", Eighth Edition, Prentice Hall India Publications, NewDelhi , (2010). 3. Ghosal,A., Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2nd reprint, 2008.3. 4. A Nagoor kani, "Control Systems", 2nd Edition, RBA Publications, 2014.

Reference Books :1. K Ogata, "Modern Control Engineering", Fifth Edition, Prentice Hall India Publication, New Delhi , (2010). 2. M.Gopal, "Control Systems Principles and Design", Fourth Edition, Tata Mc-Graw Hill Publications, (2012). 3. Fu,K., Gonzalez, R. and Lee, C. S. G., Robotics: Control, S e n sin g,Visio n a n d Intelligence, McGraw - Hill, 1987. 4. Dhanesh N. Manik, "Control Systems", First edition, Cengage Learning Pvt. Ltd., (2012).

Web Links :1. https://nptel.ac.in/courses/108106098/ 2. https://nptel.ac.in/courses/112105249/

MOOCS :https://www.coursera.org/specializations/robotics

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4G Wireless Technologies & Cellular Communications

Course Code: 18EC3092 **L-T-P-S: 3-0-0-0**

Pre-requisite: NIL **Credits: 3**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Spreading Sequences and Multiuser systems	PO1	2
CO2	Multi carrier Communication Systems	PO1	3
CO3	MIMO systems – spatial multiplexing. Ultra Wide band Communications	PO1	3
CO4	Advanced cellular communications and Miscellaneous topics	PO1	2

Syllabus : Spreading Sequences and Multiuser systems: Properties of spreading sequences, PN sequences, Gold Sequences and Walsh Sequences. Orthogonal variable spreading factor sequences (OVSF). Introduction to CDMA, DSCDMA, Multiuser detection, DSSS Techniques, FHSS verses DSSS; Multi carrier Communication Systems: Introduction to multiuser modulations, Principal of OFDM (Block Diagram), Cyclic Prefix, Introduction to long term evaluation(LTE-5E), Transceivers, Channel estimation, OFDM issues, Peak to Average Power ratio (PAPR), Carrier frequency Offset (CFO), Synchronization, PAPR reduction techniques, Multicarrier and Multi-access Systems- OFDMA, MCCDMA. MIMO systems – spatial multiplexing. Ultra-Wideband Communications: Channel Models, VBAST Architecture, Channel Modeling, SIMO, MISO, MIMO fading channels- MIMO diversity-Almouty, Orthogonal space time block code, OSTBC- MIMO-SSG; MIMO-OFDM, Introduction to features of UWB technology- applications, UWB indoor channel, UWB Capacity, Pulsed UWB, Pulse shape, Modulation and Multiple access of Pulse UWB, Time Hopping, DSUWB. Advanced cellular communications and Miscellaneous topics: Study of 60 GHz cellular systems, Cellular fixed stations, Cellular systems in rural service areas, Diversity media

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systems with millimeter wave and Optical wave link and Cellular radio telecommunications systems, Cell Handoff, Cellular switching-Analog and Digital, Call routing-Special features of handling traffic. Challenges for Pulsed UWB systems- Multiband UWB-Modulation of Pulsed Multiband UWB, Multiband OFDM UWB, Introduction to 5G.

Text Books :1 KE-Lin DU and M.N.Swamy, Wireless Communication Systems. 2 David TSE and PromodViswanadhan, Fundamentals of Wireless communication 3 William C.Y.Lee Mobile cellular Telecommunications TMH Publications 2006

Reference Books :SAVO Glisic, Advanced Wireless communications 4G Technologies.

Web Links :1. https://www.tnuda.org.il/en/physics-radiation/radio-frequency-rf-radiation/cellular-communication-network-technologies 2. https://en.wikipedia.org/wiki/Cellular_network 3. https://www.electronics-notes.com/articles/connectivity/cellular-mobile-phone/what-is-cellular-communications.php 4. https://www.sciencedirect.com/topics/computer-science/cellular-communication 5. https://www.nature.com/scitable/topic/cell-communication-14122659/

MOOCS:1. https://nptel.ac.in/courses/117/104/117104099/ 2. https://nptel.ac.in/content/syllabus_pdf/117104099.pdf 3. https://www.youtube.com/playlist?list=PLbMVogVj5nJSi8FUsvglRxLtN1TN9y4nx 4. http://ugcmoocs.inflibnet.ac.in/ugcmoocs/download/course/curriculum/nptel/noc18-ee21.pdf

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Data Networks & Protocols

Course Code: 18EC3109 **L-T-P-S: 3-0-2-0**

Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO 1	Introduction to Computer networks and Data Link Layer: Basics of networking models and topologies with basics of physical layer and design issues of data link layer, error and flow control mechanisms	PO2,PO4,PO5,PO6,PO8,PSO1,PO9,PSO2,PO10,PO1,PO12	2
CO 2	Network layer and Internetworking: Basics of network layer, design issues, Routing protocols and addressing modes	PSO1,PO9,PSO2,PO10,PO1,PO12,PO2,PO4,PO5,PO6,PO8	3
CO 3	Transport layer, Session Layer, Presentation Layer and Application Layer: Design issues of transport layer, ISNS Internet Storage Name Service	PO5,PO6,PO8,PSO1,PO9,PSO2,PO10,PO1,PO12,PO2,PO4	3
CO 4	Cryptography, Advancements in Application layer, Network Security	PO1,PO12,PO2,PO4,PO5,PO6,PO8,PSO1,PO9,PSO2,PO10	2

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CO 5	Data Network and Protocols Laboratory	PO6,PSO1,PO8,PSO2,PO9,PO1,PO10,PO2,PO11,PO3,PO12,PO4,PO5	3

Syllabus : Introduction to Computer networks and Data Link Layer: Introduction to Computer networks Use of Computer Networks, Network Hardware, Network software, Reference models: OSI and TCP/IP, Example Networks, Physical Layer: The theoretical basis for Data Communication, Guided and Unguided Transmission Media, Switching, Modems, ADSL, Trunks and Multiplexing. Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet. Network layer and Internetworking Devices: Preamble to Network Layer, Distinguishing of Networking Devices and Internetworking Devices, Analysis of Router Processing: Access, core and distribution. VLANS, Ethernet Internetworking Technologies: Wired Router, Wireless Router, Gateway, CSU/DSU; Addressing: IP addressing (IPV4 & IPV6), subnetting; Types of Routing: static, default and dynamic. Networking Protocols: RIP, OSPF, BGP; Access Control list for IPV4, IPV6, Other Protocols: NAT, ARP, Port Address Translation (PAT), IP Tunneling; DHCP. Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fibre Channel Protocol; Stream Control Transmission Protocol (SCTP); Congestion Control: Open Loop, Closed Loop Choke Packets; Quality of Service: Techniques to Improve QoS: Leaky bucket algorithm, Token bucket algorithm. Session Layer: ISNS Internet Storage Name Service. Presentation Layer: SSL, preface of Socket , Secure Socket Layer Application Layer: Telnet, TFTP, POP3, DNS, SMTP, SNMP, FTP, NTP, SSDP Advanced Topics: Cryptography: Public and Private Key based) Digital Signature, Firewalls Advancements in Application layer: ISDN services & ATM, DSL technology, wired and wireless Modem: Architecture & Operation in brief, Wireless LANs: IEEE 802.11; Multi-Band Routers (Tri Band Wireless Routers); Network Security: Essential Steps for Configuring a New Server and firewalls, Different types of network layer attacks and IP security.

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Text Books : Text Books 1 Data Communications and Networking (3rd Ed.) "–B. A. Ferouzan – TMH 2 Computer Networks (4th Ed.)", A. S. Tanenbaum – – Pearson Education/PHI

Reference Books :1 Data and Computer Communications (5th Ed.)" – W. Stallings – PHI/ Pearson Education 2 Network for Computer Scientists & Engineers, Zheng & Akhtar, OUP 3 Data & Computer Communication, Black, PHI 4 Data Communication & Network, Miller, Vikas 5 Digital & Data Communication, Miller, Jaico 6 Understanding Data Communication & Network, Shay Vikas

Web Links :https://www.coursera.org/learn/computer-networking
https://www.futurelearn.com/courses/introduction-to-networking
https://lagunita.stanford.edu/courses/Engineering/Networking-SP/SelfPaced/about

MOOCS : The Bits and Bytes of Computer Networking (Coursera) Nov 11th 2019. Google. ... An Introduction to Computer Networking for Teachers (Future Learn) Oct 7th 2019. Raspberry Pi Foundation. ... Introduction to Computer Networking (Stanford Online) Self-Paced. ... CompTIA A+ (Cybrary) Self-Paced. ... Operating Systems (saylor.org) Self-Paced

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Electronic Instruments & Biomedical Applications

Course Code: 18EC4084 **L-T-P-S: 3-0-0-2**

Pre-requisite: NIL **Credits: 3.5**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the fundamentals of Electronic Instrumentation	PO1,PO2	2
CO2	Explore the Electronics Instruments and Buses range of instruments and their connectivity in a rackmount using different buses),	PO2,PO1	2
CO3	Interpret the Basics of Biomedical Electronics	PO1,PO2	2
CO4	Applications of Bio-medical Electronics (Ex: IoT in healthcare, remote robotic controlled operations, telemedicine, Medical Electronics Instruments etc.]	PO1,PO2	2

Syllabus: Fundamentals of Electronic Instrumentation: Fundamentals of Electronic Instrumentation - Classification and Characteristics of Transducers - Static and Dynamic - Errors in Measurements and their statistical analysis. Calibration - Primary and secondary standards. Sensors and measurements: Active and passive transducers, Resistance, inductance and capacitor measurements. Strain Gauge: LVDT, RTD, Thermistor, thermo couple etc Electronics Instruments and Buses [range of instruments and their connectivity in a rack-mount using different buses. Analog and digital measuring Instruments: Ohm meter, AC/DC Ammeter and Voltmeters. CRT: Measurements of Voltage, current, phase and frequency, Signal generators, sweep generators. ADC, Signal conditioning, Instrumentation Amplifiers, Digital instruments: Digital Multimeter, Digital

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Tachometer, Ultrasonic Distance meter, Digital Thermometer, Digital pH meter, Digital capacitance meter. Interfacing buses. Basics of Biomedical Electronics: Overview of Medical Electronics Equipment's, classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments. Bio-Electrodes Bioelectric signals, Bio electrodes, Electrode, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG, EMG and EEG Applications of Bio-medical Electronics (Ex: IoT in healthcare, remote robotic controlled operations, tele-medicine, Medical Electronics Instruments etc.] Bio Medical Recorders, Patient Monitoring Systems • Heart rate measurement • Pulse rate measurement • Respiration rate measurement • Blood pressure measurement • Principle of defibrillator and pace marker. Safety Aspects of Medical Instruments • Gross current shock • Micro current shock • -Special design from safety consideration • Safety standards

Text Books :1. A.K.Sawhney,—Electrical & Electronics Measurement And Instrumentationl,10th Edition, Dhanpatrai& Co, New Delhi, 19th Revised Edition 2011, Reprint 2014. 2.Handbook Of Biomedical Instrumentation By Rs Khandpur

Reference Books :1.Leshie Cromwell, Fred. J. Weibell And Erich. A. Pfeiffer, "Biomedical Instrumentation And Measurements", 2nd Edition, Phi, 2003. 2.John G. Webster, Medical Instrumentation: Application And Design, 3rd Edition, John Wiley &Sons, New York, 1998. 3.R.Anandanatarajan, "Biomedical Instrumentation", Phi Learning, 2009.

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Technical Skill - 1 (Coding)

Course Code:18SC1106 **L-T-P-S: 0-0-0-6**

Pre-requisite: NIL Credits: 1.5

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Introduction to Servelets: Lifecycle of a Serverlet, JSDK The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters.	PO1,PO2,PSO1	3
CO2	The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, servlet chaining-Security Issues.Common Gateway Interface (CGI), Lifecycle of a Servlet,deploying a servlet,	PO1,PSO1	3
CO3	Introduction to JSP The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat	PO1,PO2,PSO1	3
CO4	JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations.	PO1,PO2	3

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Syllabus: Introduction to Servelets: Lifecycle of a Serverlet, JSDK The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, servlet chaining-Security Issues.Common Gateway Interface (CGI), Lifecycle of a Servlet,deploying a servlet, Introduction to JSP The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations. Database Access Database Programming using JDBC Studying Javax.sql. package Accessing a Database from a JSP Page Application – Specific Database Actions Deploying JAVA Beans in a JSP Page. Introduction to struts framework.

Text Books : The complete reference Java –2: V Edition By Herbert Schildt Pub. TMH.

Reference Books :1. Programming with Java, by E. Balagurusamy, McGraw Hill Education 2. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.

Web Links :1. https://www.javatpoint.com/java-jdbc 2. https://www.javatpoint.com/jdbc-driver 3. https://www.javatpoint.com/steps-to-connect-to-the-database-in-java 4. https://www.javatpoint.com/Statement-interface 5. https://www.javatpoint.com/ResultSet-interface

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Technical Skill - 2 (Coding)

Course Code: 18SC1207 **L-T-P-S: 0-0-0-6**

Pre-requisite: NIL **Credits: 1.5**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Apply the concepts of basic programming to solve the basic problems, pattern based problems	PO1,PO2	3
CO2	Build solutions for problems on Numbers and array based problems , functions, recursion	PO2,PO1	3
CO3	Solve problems solutions for character/string based problems and pointers	PO1,PO2	3
CO4	Build solutions to programs on Data structures concepts.	PO1,PO2	3
CO5	Hacker rank problem solved	PO1,PO2	4

Syllabus : Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning

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lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension.Illustrative programs: selection sort, Insertion sort, merge sort, histogram.

Text Books :1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3,Shroff/O'Reilly Publishers, 2016 http://greenteapress.com/wp/thinkpython/) 2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Books :1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013. 2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised And expanded Edition, MIT Press, 2013 3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012. 4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013. 5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016. 6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

Web Links :WEB REFERNCES/MOOCs: 1) www.hackerrank.com 2) www.codechef.com 3) www.spoj.com 4) www.hackerearth.com 5) www.geeksforgeeks.com 6) www.w3resource.com 7) http://poj.org/problem?id=1000 8) https://uva.onlinejudge.org

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Syllabus for New M. Tech Course for VLSI added in AY. 2018-19

IC Fabrication Technology

Course Code: 18EC5131 **L-T-P-S: 3-1-0-0**

Pre-requisite: NIL **Credits: 4**

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Ability to understand the Concepts of fabrication and steps following for fabrication	PO1	1
CO2	Understand different modelling technologies and materials used for fabrication	PO1	2
CO3	Ability to understand the concepts of lithography and deposition	PO4	2
CO4	Analyze the various etching technologies for preparation of ICs	PO1	2

Syllabus :TEXT BOOKS: 1. S.M.Sze (2nd Edition) "VLSI Technology", McGraw Hill Companies Inc. 2. C.Y. Chang and S.M.Sze (Ed), "ULSI Technology", McGraw Hill Companies Inc. Introduction to IC Technology: Basic fabrication steps and their Importance. Environment of IC Technology: Concepts of Clean room and safety requirements, Concepts of Wafer cleaning processes and wet chemical etching techniques. Impurity Incorporation: Solid State diffusion modelling and technology; Ion Implantation modelling, technology and damage annealing, characterization of Impurity profiles. Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultra-thin films, Oxidation technologies in VLSI and ULSI, Characterization of oxide films, High k and low k dielectrics for ULSI. Lithography: Photolithography, E-beam lithography and

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newer lithography techniques for VLSI/ULSI, Mask generation. Chemical Vapour Deposition Techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films. Epitaxial growth of silicon: modelling and technology. Metal Film Deposition: Evaporation and sputtering techniques, Failure mechanisms in metal interconnects Multi-level metallization schemes. Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

Text Books :1. S.M.Sze (2nd Edition) "VLSI Technology", McGraw Hill Companies Inc. 2. C.Y. Chang and S.M.Sze (Ed), "ULSI Technology", McGraw Hill Companies Inc.

Reference Books :1. Stephen Campbell, "The Science and Engineering of Microelectronic Fabrication", Second Edition, Oxford University Press. 2. James D.Plummer, Michael D.Deal, "Silicon VLSITechnology" Pearson Education

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Annexure V

List of Value-Added Course

Name of the value-added courses offered (with 30 or more contact hours)	Year of offering	No. of times offered during the same year
Arduino	2018-2019	2
Python Programming	2018-2019	2
NILAB View	2018-2019	2

These value added courses are selected and floated by performing a survey performing a survey nationally and internationally for skill development aiming towards employment opportunities.

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