SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)
Puducherry

1st PG - Board of Studies Meeting in the department of
Electronics and Communication Engineering

for the Programmes
M.Tech – Electronics and Communication Engineering
Ph.D – Electronics and Communication Engineering

Venue
Seminar Hall, Department of ECE
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time
18-07-2020 & 11.00 am
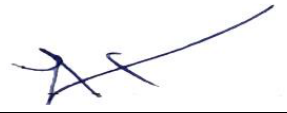
Minutes of Board of Studies

The first Board of Studies meeting for PG and PhD programmes was held on 18th July 2020 at 11:00 A.M in the Seminar Hall, Department of ECE, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. P. Raja** Professor and Head Department of ECE, SMVEC	Chairman	
External Members			
2	**Dr.Gerardine Immaculate Mary** Professor, Department of Embedded Systems, Vellore Institute of Technology (VIT), 600048, Vellore, Tamil Nadu, India	University Nominee	
3	**Dr. N. Venkateswaran** Professor, Department of ECE, SSN - College of Engineering, Rajiv Gandhi Salai (OMR) Kalavakkam – 603 110	Academic Member	

No.	Member Details	Role	Signature
4	**Dr. V. R. Vijayakumar** Associate Professor & Head, Department of ECE, Anna University, Regional Campus, Coimbatore – 46	Academic Member	
5	**Mr. C. Gnanavel** Manager, Production and Technology Lenovo India Ltd., Puducherry-605007	Industry Member	
Internal Members			
6	**Dr.V.Bharathi,** Professor / ECE **Specialization:** Wireless Communication	Member	
7	**Dr.R.Ramya,** Professor/ ECE **Specialization:** ECE	Member	
8	**Dr. J.Pradeep,** Associate Professor / ECE **Specialization:** Image Processing	Member	
9	**Dr. R.Kurunjimalar,** Associate Professor / ECE **Specialization:** Mobile Satellite Communication	Member	
10	**Dr. D. Jagadiswary** Associate Professor / ECE **Specialization:** Biometric Security	Member	
11	**Prof. R. Ilaiyaraja** Assistant Professor / ECE **Specialization:** VLSI Design	Member	
12	**Prof.Egalite Francis** Assistant Professor **Specialization:** Mathematics	Member	
13	**Prof. K. Oudayakumar** Associate Professor **Specialization:** Physics	Member	
14	**Dr. S. Deepa** Professor **Specialization:** Chemistry	Member	
15	**Dr.D.Jaichithra** Associate Professor **Specialization:** English	Member	
Co-opted Members			
16	**Mr. Dharanidharan. G** Associated Functional Consultant, Birlasoft Limited No 283/4, Prince info-city -II,8th Floor,A Wing, Old Mahabalipuram Road, Chennai - 600096	Alumni Member	

Item No.	Particulars
BoS/PG/ECE 1.1	Discuss about the curriculum Structure of M.Tech – Electronics and Communication Engineering
BoS/PG/ECE 1.2	To discuss and approve the M.Tech. Degree Regulations 2020 (R-2020), Curriculum and Syllabi from I to IV semesters for the M.Tech – Electronics and Communication Engineering for the students admitted in the Academic Year 2020-21
BoS/PG/ECE 1.3	To discuss and approve the M.Tech. Degree Regulation 2019, Curriculum, syllabi from I to IV semesters under for the M.Tech – Electronics and Communication Engineering for the students admitted in the Academic Year 2019-20
BoS/PG/ECE 1.4	To discuss about the uniqueness of the PG Curriculum
BoS/PG/ECE 1.5	To discuss and approve Evaluation Systems
BoS/PG/ECE 1.6	To discuss and approve Regulations 2020 (R-2020) for PhD in Electronics and Communication Engineering

MINUTES OF THE MEETING

Dr. P. Raja, Chairman, BoS opened the meeting by a warm welcome and introduced the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies. The Chairman proceeded with the presentation about the Institution Accreditation, Autonomous status, Department details intake and staff details, and the meeting thereafter deliberated on agenda items the Chairman.

BoS/PG/ECE 1.1	The BoS members reviewed the curriculum of M.Tech. Electronics and Communication Engineering and appreciated the following points *Appreciated the following* • Approved the credit limit for the PG programme under regulations 2020 • The structure of the course has an efficient flow of engineering knowledge • Appreciated the "online course" and "internship" of the curriculum • The coursed introduced under the category of Employability and Enhancement courses and Mandatory courses are improve the student's skill *Suggested the following* • Suggestion to lower the credit from 4 to 3 for courses except for mathematics • Suggested to introduce NPTEL course from 1st semester itself • Suggested to introduce one laboratory course in third semester. *Suggestions are considered and updated curriculum is provided in Annexure-I* ***Recommended to Academic Council***

BoS/PG/ECE 1.2	The BoS members reviewed M.Tech. Degree Regulations 2020 (R-2020), Curriculum and Syllabi from I to IV semesters and suggested the following points. • Suggested replacing the course High-Speed Semiconductor Device and VLSI for wireless communication courses and bringing the appropriate elective course into core courses offered in the first semester. • Suggested to modify the course title of "Modern Communication system" into 5G communication. • Suggested upgrading the syllabus for the course "Statistical Signal Processing" and the course of "Advanced DSP" offered in the second semester. • Suggested to include "ARM and Cortex processors" in the course of "Advanced Microcontrollers" offered in the second semester *Suggestions are considered and updated in the syllabi of respective courses. The details are provided in Annexure-II* ***Recommended to Academic Council***
BoS/PG/ECE 1.3	The BoS members discussed and approved the M.Tech. Degree Curriculum, syllabi from I to IV semesters under Pondicherry Regulation 2019, for the students admitted in the Academic Year 2019-20
BoS/PG/ECE 1.4	The BoS members reviewed the uniqueness of the Curriculum (R-2020) and appreciated • The Employability Enhancement Course will enhance students ' knowledge of emerging technologies • Appreciated instructional activity introduced in the fifth class of all courses • Mandatory Internship and Industry Projects in the curriculum were appreciated
BoS/PG/ECE 1.5	The Evaluation Systems is reviewed by the BoS members and suggested the following points • Internal mark evaluation based on Instructional activity for 5th unit in all courses was appreciated • External evaluation system is approved and appreciated • Suggested to conduct a review for the project along with Industry Experts
BoS/PG/ECE 1.6	The BoS members are discussed and approved regulations 2020 for the research programme PhD in Electronics and Communication Engineering.

Dr. P. Raja, Chairman – BoS and Head of Department, Electronics and Communication Engineering, concluded the meeting at 1:30 pm with vote of thanks.

Dr. P. RAJA
Chairman – BoS

CURRICULUM

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
SEMESTER – I										
Theory										
1	P20BST101	Advanced Engineering Mathematics	BS	2	2	0	3	40	60	100
2	P20ECT101	Advanced Digital Communication	PC	3	0	0	3	40	60	100
3	P20ECT102	Embedded System Design	PC	3	0	0	3	40	60	100
4	P20ECT103	Machine Learning in Communication Networks	PC	3	0	0	3	40	60	100
5	P20CCT101	Research Methodology and IPR	PC	2	0	0	2	40	60	100
6	P20ECE1XX	Professional Elective I	PE	3	0	0	3	40	60	100
Practical										
7	P20ECP101	Wireless and Mobile Communication Lab	PC	0	0	4	2	50	50	100
8	P20CCP101	Technical Report Writing & Seminar	PC	0	0	4	2	100	0	100
Audit Course										
9	P20ACT10X	Audit Course - 1	AC	2	0	0	-	100	-	100
Employability Enhancement Course										
10	P20ECC1XX	Employability Enhancement Course-I	EEC	0	0	4	-	100	-	100
Total for semester I							21	590	410	1000

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
SEMESTER – II										
Theory										
1	P20VET204	Advanced Digital System Design	PC	3	0	0	3	40	60	100
2	P20ECT205	Digital Image and Video Processing	PC	3	0	0	3	40	60	100
3	P20ECT206	Modelling and Simulation Techniques	PC	3	0	0	3	40	60	100
4	P20ECT207	Millimeter Wave Communication Networks	PC	3	0	0	3	40	60	100
5	P20ECE2XX	Professional Elective-II	PE	3	0	0	3	40	60	100
6	P20ECE2XX	Professional Elective III	PE	3	0	0	3	40	60	100
Practical										
7	P20ECP202	Digital Image and Video Processing lab	PC	0	0	4	2	50	50	100
8	P20CCP202	Seminar on ICT-a hands on approach	PC	0	0	4	2	100	0	100

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Audit Course										
9	P20ACT20X	Audit Course - 2	AC	2	0	0	-	100	-	100
Employability Enhancement Course										
10	P20ECC2XX	Employability Enhancement Course-II	EEC	0	0	4	-	100	-	100
Total for semester II							**22**	**590**	**410**	**1000**

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P20ECE3XX	Professional Elective -IV	PE	3	0	0	3	40	60	100
2	P20ECE3XX	Professional Elective- V	PE	3	0	0	3	40	60	100
3	P20ECE3XX	Professional Elective- VI	PE	3	0	0	3	40	60	100
Practical										
4	P20ECW301	Project Phase-I	PW	0	0	12	6	50	50	100
5	P20ECW302	Internship	PW	0	0	0	2	100	-	100
Employability Enhancement Course										
6	P20ECS301	NPTEL/GIAN/MOOC Course	EEC	0	0	0	-	100	-	100
Total for semester III							**17**	**370**	**230**	**600**

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Practical										
1	P20ECW403	Project Phase-II	PW	0	0	24	12	50	50	100
Total for semester IV							**12**	**50**	**50**	**100**

BS – Basic Science
PC – Professional Core
PE – Professional Elective
PW – Project Work

CC – Common Course
AC – Audit Course
EEC – Employability Enhancement Course

Credit Distribution

Semester- I	Semester - II	Semester - III	Semester - IV	Total
21	**22**	**17**	**12**	**72**

Total number of credits required to complete
M.Tech in Electronics and Communication :   72 credits

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		L	T	P	C	Hours
P20ECT103	**MACHINE LEARNING IN COMMUNICATION NETWORKS**	3	0	0	3	45

Course Objectives

- To enable the student to understand the concept of machine learning and its application in wireless communication and bio-medical
- To expose the student to be familiar with a set of well-known supervised, semi-supervised and unsupervised learning algorithms
- To make students well exposed to neural network algorithms
- To Understand the concept of machine learning in communication
- To know the concept of machine learning in biomedical application

Course Outcomes

After completion of the course, the students will be able to

CO1- Demonstrate understanding of the mathematical principles underlying machine learning **(K3)**
CO2- Familiar with the different machine learning techniques and their use cases.**(K1)**
CO3- In a position to formulate machine learning problems corresponding to different applications **(K3)**
CO4- Able to recognize the characteristics of machine learning techniques that are useful to solve real-world problems **(K1)**
CO5- In a position to read current research papers, understand the issues and the machine learning based solution approaches **(K4)**

UNIT I: MATHEMATICAL BACKROUND **(9 Hrs)**
Linear Algebra – Arithmetic of matrices, Norms, Eigen decomposition, Singular value decomposition, Pseudo inverse, Principal Component analysis. Probability theory – probability distribution, conditional probability, Chain rule, Bayes rule, Information theory, Structured Probabilistic models.

UNIT II: MACHINE LEARNING BASICS **(9 Hrs)**
Supervised and Unsupervised learning, Capacity, Overfitting and Underfitting, Cross Validation, Linear regression, Logistic Regression, Regularization, Naive Bayes, Support Vector Machines (SVM), Decision tree, Random forest, K-Means Clustering, k nearest neighbor.

UNIT III: NEURAL NETWORKS **(9 Hrs)**
Feed forward Networks , Back propagation, Convolutional Neural Networks-LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks. Recurrent Neural Network(RNN) – Back propagation through time (BPTT), Vanishing and Exploding Gradients.

UNIT IV: ML IN WIRELESS AND SECURITY **(9 Hrs)**
Water-filling power allocation, Optimization for MIMO Systems, OFDM Systems and MIMO-OFDM systems. Optimization in beam former design – Robust receive beam forming, Transmit downlink beam forming. Application: Radar for target detection, Array Processing, MUSIC, ML in Side channel analysis.

UNIT V: INSTRUCTIONAL ACTIVITIES **(9 Hrs)**
Case studies on Machine Learning in Medical Imaging. Deep Learning for Health Informatics. Deep Learning Automated ECG Noise Detection and Classification System for Unsupervised Healthcare Monitoring. Techniques for Electronic Health Record (EHR) Analysis.

Text Books

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep learning",Cambridge,MA", MIT Press, 2017.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill, 1997.
3. Ethem Alpaydın, "Introduction to machine learning", MIT Press, 3rd Edition, 2014.

Reference Books

1. Kevin P. Murphy, "Machine Learning - A Probabilistic Perspective", The MIT Press, Cambridge, 2012.
2. Josh Patterson and Adam Gibson, "Deep Learning - A Practitioner's Approach", O'Reilly Media, Inc, 2017.
3. Francesco Camastra, Alessandro Vinciarelli," Machine Learning for Audio, Image and Video Analysis", Springer,2015
4. Patanjali Kashyap "Machine Learning for Decision Makers" Apress, 2017

Web References

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee31/
3. https://nptel.ac.in/courses/117/108/117108048/

COs/ POs/ PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	-	3	3	-	-	1	-	3
2	3	-	3	3	-	-	1	-	3
3	3	-	3	3	-	-	1	-	3
4	3	-	3	3	-	-	1	-	3
5	3	-	3	3	3	-	1	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

| | | L | T | P | C | Hours |
| **P20ECT207** | **MILLIMETER WAVE COMMUNICATION NETWORKS** | 3 | 0 | 0 | 3 | 45 |

Course Objectives

- To make students aware about the Millimeter wave characteristics
- The student must be able to estimate the Millimeter wave design consideration
- To introduce the students some practical aspects of link budget in Millimeter wave
- Understand the theory and concepts of beam steering
- Comprehend the fundamentals of MIMO

Course Outcomes

After completion of the course, the students will be able to
CO1 - Develop an understanding on standards of Millimeter wave **(K3)**
CO2 - Have an ability to analyze various antennas used in millimeter **(K4)**
CO3 - Develop an ability to use different modulation techniques **(K4)**
CO4 - Have an ability to analyze various Beam steering and beam forming technology **(K4)**
CO5 - Simulate various MIMO configurations **(K4)**

UNIT I MULTI-GIGABIT 60-GHz MILLIMETER WAVE RADIOS (9 Hrs)
Millimeter wave characteristics-Channel performance at 60GHz, Gigabit wireless communication, Standards- WiGig, IEEE 802.11ad, IEEE 802.15.3c,WirelessHD,ECMA-387/ISO/IEC 13156,Coexistence with wireless backhaul, Millimeter wave applications- WLAN, WPAN, Outdoor point to point.

UNIT II MILLIMETER WAVE ANTENNAS (9 Hrs)

Path loss and antenna directivity, Antenna beam width, Maximum possible gain to Q, Polarization, Beam steering antenna, Millimetre wave design consideration

UNIT III MILLIMETER WAVE TRANSCEIVERS (9 Hrs)

Millimeter wave link budget, Transceiver architecture, Receiver without local oscillator, Millimeter wave calibration, Modulation techniques-OOK, PSK, FSK, QAM, OFDM.

UNIT IV ADVANCED BEAM STEERING AND BEAM FORMING (9 Hrs)
Need for beam steering and beam forming, Adaptive frame structure-Advanced beam steering technology, Advanced beam forming technology, Advanced antenna ID technology.

UNIT V INSTRUCTIONAL ACTIVITIES (9 Hrs)
Simulations on Spatial diversity of antenna arrays, Multiple antennas, Multiple transceivers, Noise coupling in MIMO system.

Text Books

1. Kao-Cheng Huang, Zhaocheng Wang, "Millimeter wave communication systems",John Wiley & Sons, Hoboken, New Jersey, 2011.
2. Jonathan Wells, "Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications",Artech House, 2010.
3. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.

Reference Books

1. Jonathan Wells, "Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications",Artech House, 2010.
2. Su-Khiong Yong, Pengfei Xia and Alberto Valdes-Garcia, "60GHz Technology for Gbps WLAN and WPAN: From Theory to Practice", Wiley 2010
3. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015
4. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research", Wiley, 2018
5. Randy. L, Haupt, "Antenna Arrays, A Computational Approach", John Wiley & Sons, 2010.

Web References

1. https://nptel.ac.in/courses/117/105/117105139/
2. https://onlinecourses.nptel.ac.in/noc20_ee71/preview
3. https://web.stanford.edu/class/ee359/lectures.html
4. https://www.digimat.in/nptel/courses/video/117105139/L01.html
5. https://www.youtube.com/watch?v=QE-GmtXIKGs

COs/ POs/ PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	1	3	3	-	-	2	-	3
2	3	1	3	3	-	-	2	-	3
3	3	1	3	3	-	-	2	-	3
4	3	1	3	3	-	-	2	-	3
5	3	1	3	3	3	-	2	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

	L	T	P	C	Hours

P20ECT205   **DIGITAL IMAGE AND VIDEO PROCESSING**   **3   0   0   3   45**

Course Objectives

• Learn different techniques for image enhancement, video and image recovery
• Understand techniques for image and video segmentation
• Study techniques for image and video compression and object recognition
• Deals about different colour models in video processing
• Learn about the noise model for real time environment

Course Outcomes

After completion of the course, the students will be able to

CO1 - Learn different techniques for image enhancement, video and image recovery **(K1)**
CO2 - Understand techniques for image and video segmentation **(K2)**
CO3 - Study techniques for image and video compression and object recognition**(K2)**
CO4 - Study about different colour models and processing techniques **(K2)**
CO5 - Analysis the noise in real time environment**(K4)**

UNIT I DIGITAL IMAGE AND VIDEO FUNDAMENTALS   **(9 Hrs)**
Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/interpolation, video sampling and interpolation, Basic image processing operations, Image Transforms Need for image transforms, DFT, DCT, Walsh, Hadamard transform, Haar transform, Wavelet transform

UNIT II IMAGE AND VIDEO ENHANCEMENT AND RESTORATION   **(9 Hrs)**
Histogram, Point processing, filtering, image restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, deinterlacing, video resolution enhancement, Image and Video restoration (recovery).

UNIT III IMAGE AND VIDEO SEGMENTATION   **(9 Hrs)**

Discontinuity based segmentation- Line detection, edge detection, thresholding, Region based segmentation, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation, Morphological image processing.

UNIT IV WAVELET TRANSFORM   **(9 Hrs)**
Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Full colour processing

UNIT V INSTRUCTIONAL ACTIVITIES   **(9 Hrs)**
Audio and video analysis for the real time environment; noise cancellation in image using adaptive filters; Video recognition and speech-to-text conversion using related tools.

Text Books

1. Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.
2. J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", 2nd Edition, Academic Press, 2011.
3. Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.

Reference Books

1. J.G.Proakis and D.G.Manolakis "Digital signal processing: Principles, Algorithm and Applications", 4^{tj} Edition, Prentice Hall, 2007.
2. N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 3rd Edition, John Wiley and Sons Ltd, 2009.
3. Lokenath D and Firdous A S, "Wavelet Transforms and Their Applications", 2nd Edition, Birkhauser, Springer, 2014.
4. A. M. Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.
5. S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford University Press, 2016.

Web References

1. www.ece.umd.edu/class/enee630.F2012.html
2. http://ar.book.org/s/?q=DSP+PROAKIS&yearFrom=&yearTo=&language=&extension=&t=0
3. https://www.coursera.*org*/learn/digital
4. http://www.nptelvideos.in/2012/12/digital-image-processing.html
5. https://nptel.ac.in/courses/117/105/117105079/

COs/ POs/ PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	1	2	2	-	-	1	-	3
2	3	1	2	2	-	-	1	-	3
3	3	1	2	2	-	-	1	-	3
4	3	1	2	2	-	-	1	-	3
5	3	1	2	2	3	-	1	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

| | **L** | **T** | **P** | **C** | **Hours** |

P20ECT206　　　**MODELLING AND SIMULATION TECHNIQUES**

L	**T**	**P**	**C**	**Hours**
3	**0**	**0**	**3**	**45**

Course Objectives

- Identify and model discrete systems (deterministic and random)
- Identify and model discrete signals (deterministic and random)
- Understand modelling and simulation techniques to characterize systems/processes.
- To provide an exposure to error performance analysis of wireless communication models
- To design wireless communication models through simulation tools

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify and model discrete systems (deterministic and random) **(K4)**
CO2 - Identify and model discrete signals (deterministic and random) **(K4)**
CO3 - Understand modelling and simulation techniques to characterize systems/processes. **(K2)**
CO4 - Explain an error performance analysis of wireless communication models **(K2)**
CO5 - To analyze wireless communication system model simulation tools **(K4)**

UNIT I INTRODUCTION (9 Hrs)
Introduction Circuits as dynamic systems, Transfer functions, poles and zeroes, State space, Deterministic Systems, Difference and Differential Equations, Solution of Linear Difference and Differential Equations, Numerical Simulation Methods for ODEs, System Identification, Stability and Sensitivity Analysis.

UNIT II STATISTICAL MODEL (9 Hrs)
Statistical methods, Description of data, Data-fitting methods, Regression analysis, Least Squares Method, Analysis of Variance, Goodness of fit.

UNIT III RANDOM MODELS (9 Hrs)
Probability and Random Processes, Discrete and Continuous Distribution, Central Limit theorem, Measure of Randomness, Monte Carlo Methods.

UNIT IV MODELING (9 Hrs)
Stochastic Processes and Markov Chains, Time Series Models. Modeling and simulation concepts, Discrete-event simulation, Event scheduling/Time advance algorithms, Verification and validation of simulation models.

UNIT V INSTRUCTIONAL ACTIVITIES (9 Hrs)
Continuous simulation: Modeling with differential equations, Example models, Bond Graph Modeling, Population Dynamics Modeling, System dynamics.

Text Books
1. R. L. Woods and K. L. Lawrence, "Modeling and Simulation of Dynamic Systems", Prentice-Hall, 1997.
2. Z. Navalih, "VHDL Analysis and Modelling of Digital Systems", McGraw-Hill, 1993.
3. J. Banks, JS. Carson and B. Nelson, "Discrete-Event System Simulation", 2nd Edition, Prentice-Hall of India, 1996.

Reference Books

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Guillaume De La Roche, Andres Alayon Glazunov and Ben Allen, "LTE – Advanced and Next Generation Wireless Networks: Channel Modelling and Propagation", John Wiley and Sons Ltd., 2013
3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
4. Michel Daoud Yacoub, "Wireless Technology: Protocols, Standards, and Techniques", CRC Press, 2002.
5. Jafarkhani H, "Space-Time Coding: Theory & Practice", Cambridge University Press, 2005.

Web References

1. https://saravanyablog.files.wordpress.com/2017/04/andreas-f-molisch-wireless-comm.pdf
2. http://freevideolectures.com/Course/2329/Wireless-Communication
3. https://videoken.com/search-results
4. http://ee.sharif.edu/~wireless.comm.net/references/Tse,FundamentalsofWirelessCommunication.pdf
5. http://ee.sharif.edu/~pr.wireless.comm/references/Goldsmith.pdf

COs/ POs/ PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	1	2	1	-	-	1	1	3
2	3	1	2	1	-	-	1	1	3
3	3	1	2	1	-	-	1	1	3
4	3	1	2	1	-	-	1	1	3
5	3	1	2	1	3	-	1	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)
Puducherry

1st PG - Board of Studies Meeting in the department of
Electronics and Communication Engineering

for the Programme
M.Tech – VLSI and Embedded Systems

Venue
Seminar Hall, Department of ECE
Sri ManakulaVinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time
18-07-2020 & 11.00 am

Minutes of Board of Studies

The first Board of Studies meeting for M.Tech – VLSI and Embedded Systems and Ph.D programmes was held on 18th July 2020 at 11:00 A.M in the Seminar Hall, Department of ECE, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. P. Raja** Professor and Head Department of ECE, SMVEC	Chairman	
External Members			
2	**Dr.Gerardine Immaculate Mary** Professor, Department of Embedded Systems, Vellore Institute of Technology (VIT), 600048, Vellore, Tamil Nadu, India	University Nominee	
3	**Dr. N. Venkateswaran** Professor, Department of ECE, SSN - College of Engineering, Rajiv Gandhi Salai (OMR) Kalavakkam – 603 110	Academic Member	
4	**Dr. V. R. Vijayakumar** Associate Professor & Head,	Academic Member	

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	Department of ECE, Anna University, Regional Campus, Coimbatore – 46		
5	**Mr. C. Gnanavel** Manager, Production and Technology Lenovo India Ltd., Puducherry-605007	Industry Member	
Internal Members			
6	**Dr.V.Bharathi,** Professor / ECE **Specialization:** Wireless Communication	Member	
7	**Dr.R.Ramya,** Professor/ ECE **Specialization:** ECE	Member	
8	**Dr. J.Pradeep,** Associate Professor / ECE **Specialization:** Image Processing	Member	
9	**Dr. R.Kurunjimalar,** Associate Professor / ECE **Specialization:** Mobile Satellite Communication	Member	
10	**Dr. D. Jagadiswary** Associate Professor / ECE **Specialization:** Biometric Security	Member	
11	**Prof. R. Ilaiyaraja** Assistant Professor / ECE **Specialization:** VLSI Design	Member	
12	**Prof.Egalite Francis** Assistant Professor **Specialization:** Mathematics	Member	
13	**Prof. K. Oudayakumar** Associate Professor **Specialization:** Physics	Member	
14	**Dr. S. Deepa** Professor **Specialization:** Chemistry	Member	
15	**Dr.D.Jaichithra** Associate Professor **Specialization:** English	Member	
Co-opted Members			
16	**Mr. Dharanidharan. G** Associated Functional Consultant, Birlasoft Limited No 283/4, Prince info-city -II,8th Floor,A Wing, Old Mahabalipuram Road, Chennai - 600096	Alumni Member	

AGENDA OF THE MEETING

Item No.	Particulars
BoS/PG/VLSI 1.1	Discuss the curriculum Structure of M.Tech – VLSI and Embedded Systems
BoS/PG/ VLSI 1.2	To discuss and approve the M.Tech. Degree Regulations 2020 (R-2020), Curriculum and Syllabi from I to IV semesters for the M.Tech – VLSI and Embedded Systems for the students admitted in the Academic Year 2020-21
BoS/PG/ VLSI 1.3	To discuss and approve the M.Tech. Degree Regulation 2019, Curriculum, syllabi from I to IV semesters under for the M.Tech – VLSI and Embedded Systems for the students admitted in the Academic Year 2019-20
BoS/PG/ VLSI 1.4	To discuss about the uniqueness of the PG Curriculum
BoS/PG/ VLSI 1.5	To discuss and approve Evaluation Systems

MINUTES OF THE MEETING

Dr. P. Raja, Chairman, BoS opened the meeting by a warm welcome and introduced the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies.

The Chairman proceeded with the presentation about the Institution Accreditation, Autonomous status, Department details intake and staff details, and the meeting thereafter deliberated on agenda items that had been approved by the Chairman continued with the meeting Agenda

BoS/PG/ VLSI 1.1	The BoS members reviewed the curriculum of M.Tech. VLSI and Embedded Systems and highlighted the following points *Appreciated the following* • Approved the credit limit for the PG programme under regulations 2020 • Course structure is having an efficient flow of engineering knowledge • Appreciated the "online course" and "internship" in the curriculum • The coursed introduced under the category of Employability and Enhancement courses and Mandatory courses are really improve the students' skill *Suggested the following* • Suggestion to lower the credit from 4 to 3 for courses except for mathematics • Suggested to introduce NPTEL course from 1st semester itself • Suggested to bring the elective course 'System on Chip', 'Robotics and Automation and 'Testing of VLSI Circuits' courses into a corcoursesse in the curriculum • Suggested introducing one laboratory course in the hird semester.

	Suggestions are considered and updated curriculum is provided in Annexure-I
	Recommended to Academic Council.
BoS/PG/ VLSI 1.2	The BoS members reviewed M.Tech. Degree Regulations 2020 (R-2020), Curriculum and Syllabi from I to IV semesters and suggested the following points • Suggested to include "FPGA based System Design" course instead of "Microcontroller Based System Design" • Suggested to improve the syllabi of "Soft Computing" Professional Elective – IV with advanced topics *Suggestions are considered and updated in the syllabi of respective courses. The details are provided in Annexure-II* ***Recommended to Academic Council.***
BoS/PG/ VLSI 1.3	The BoS members discussed and approved the M.Tech. Degree Curriculum, syllabi from I to IV semesters under Pondicherry Regulation 2019, for the students admitted in the Academic Year 2019-20
BoS/PG/ VLSI 1.4	The BoS members reviewed the uniqueness of the Curriculum (R-2020) and appreciated • Employability Enhancement Course provided to the students will enhance the students knowledge in the field of advanced technology • Instructional activity introduced in fifth unit of all courses are appreciated • Mandatory Internship and Industry Projects was appreciated
BoS/PG/ VLSI 1.5	The Evaluation Systems is reviewed by the BoS members and suggested following points • Internal mark evaluation based on Instructional activity for 5th unit in all course was appreciated • External evaluation system is approved and appreciated • Suggested to conduct Review for Project along with Industry Experts

Dr. P. Raja, Chairman – BoS and Head of Department, Electronics and Communication Engineering, concluded the meeting at 1:30 pm with vote of thanks.

 Dr. P. RAJA
Chairman – BoS

ANNEXURE - I
CURRICULUM

			SEMESTER – I							
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	P20BST106	Applied Mathematics	BS	2	2	0	3	40	60	100
2	P20VET101	Digital System Design using VHDL	PC	3	0	0	3	40	60	100
3	P20VET102	VLSI Design Techniques	PC	3	0	0	3	40	60	100
4	P20VET103	FPGA Based System Design	PC	3	0	0	3	40	60	100
5	P20CCT101	Research Methodology and IPR	PC	2	0	0	2	40	60	100
6	P20VEE1XX	Professional Elective-I *	PE	3	0	0	3	40	60	100
Practical										
7	P20VEP101	VLSI Design Laboratory	PC	0	0	4	2	50	50	100
8	P20CCP101	Technical Report Writing and Seminar	PC	0	0	4	2	100	-	100
Audit Course										
9	P20ACT10X	Audit Course-I**	AC	0	0	2	-	100	-	100
Employability Enhancement Course										
10	P20VEC1XX	Employability Enhancement Course-I#	EEC	0	0	4	-	100	-	100
		Total					**21**	**590**	**410**	**1000**

			SEMESTER – II							
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	P20VET204	Advanced Digital System Design	PC	3	0	0	3	40	60	100
2	P20VET205	Embedded Networking	PC	3	0	0	3	40	60	100
3	P20VET206	Embedded System Design	PC	3	0	0	3	40	60	100
4	P20VET207	Low Power Digital VLSI Design	PC	3	0	0	3	40	60	100
5	P20VEE2XX	Professional Elective-II*	PE	3	0	0	3	40	60	100
6	P20VEE2XX	Professional Elective-III*	PE	3	0	0	3	40	60	100
Practical										
7	P20VEP202	Embedded System Design Laboratory	PC	0	0	4	2	50	50	100
8	P20CCP202	Seminar on ICT a hands on approach	PC	0	0	4	2	100	-	100
Audit Course										
9	P20ADC20X	Audit Course-II**	AC	-	-	2	-	100	-	100
Employability Enhancement Course										
10	P20VEC2XX	Employability Enhancement Course-II#	EEC	-	-	4	-	100	-	100
		Total					**22**	**590**	**410**	**1000**

* Professional Elective Courses are to be selected from the list given in Annexure I
#Employability Enhancement Courses are to be selected from the list given in Annexure-II
** Audit Courses are to be selected from the list given in Annexure III

SEMESTER – III									
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P20VEE3XX	Professional Elective -IV*	PE	3	0	0	3	40	60	100
2	P20VEE3XX	Professional Elective- V*	PE	3	0	0	3	40	60	100
3	P20VEE3XX	Professional Elective- VI*	PE	3	0	0	3	40	60	100
Practical										
4	P20VEW301	Project Phase-I	PW	0	0	12	6	50	50	100
5	P20VEW302	Internship	PW	0	0	0	2	100	-	100
Employability Enhancement Course										
6	P20VES301	NPTEL/GIAN/MOOC	EEC	0	0	0	-	100	-	100
Total							17	370	230	600

SEMESTER – IV									
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Practical										
1	P20VEW403	Project Phase-II	PW	0	0	24	12	50	50	100
Total							12	50	50	100

Professional Elective Courses are to be selected from the list given in Annexure I

BS – Basic Science
PC – Professional Core
PE – Professional Elective
PW – Project Work
CC – Common Course
AC – Audit Course
EEC – Employability Enhancement Course

Credit Distribution

Semester-I	Semester -II	Semester -III	Semester -IV	Total
21	22	17	12	72

Total number of credits required to complete

M.Tech in VLSI and Embedded Systems: 72 Credits

P20VET103	**FPGA BASED SYSTEM DESIGN**	**L**	**T**	**P**	**C**	**Hrs**
		3	**0**	**0**	**3**	**45**

Course Objectives

- To recognize the basic modules of FPGA
- To explain how Technology is mapping with FPGA
- To outline routing concepts used in FPGA
- To provide the knowledge about various FPGA architectures
- To carryout the synthesis activities of various multipliers and filters

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe the various basic modules of FPGA.**(K2)**
CO2- Relate the technology mapping with FPGA.**(K3)**
CO3 - Discuss the routing concepts of FPGA.**(K3)**
CO4 - Classify the various FPGA architectures.**(K4)**
CO5 - Synthesise various multipliers & filters.**(K4)**

UNIT I FPGA ARCHITECTURE (9 Hrs)

Introduction of basic concepts, Digital design and FPGAs. FPGA based system design, Logic blocks, Routing architecture, FPGA Fabrics, Circuit design of FPGA fabrics, Platform FPGA.

UNIT II TECNOLOGY MAPPING FOR FPGAs (9 Hrs)

Fundamental of high level synthesis, Logic synthesis, Logic optimization and technology mapping, Lookup table technology mapping, Timing analysis, Timing optimization, Area optimization

UNIT III ROUTING FOR FPGAs (9 Hrs)

Routing terminology ,Strategy for routing in FPGAs ,Routing for row-logic block selection, Experimental procedure Logic block architecture ,Logic block functionality vs area and efficiency, Logic block selection, Experimental procedure, Logic block area and routing model.

UNIT IV ARCHITECTURE OF FPGAs (9 Hrs)

Study of Xilinx Virtex series FPGAs, Architecture of Altera cyclone FPGA series. Comparison of Xilinx & Altera FPGAs

UNIT V INSTRUCTIONAL ACTIVITY (9 Hrs)

Synthesis of multiplier and digital filters in FPGA and analyse the FPGA architecture and mapping of I/O pads

Text Books

1. Wayne Wolf, FPGA based system design, Prentice Hall, 2004.
2. Wayne Wolf, Modern VLSI design, System on Chip design, 3rd Ed. Prentice Hall 2002.
3. S. Trimberger, Edr, Field Programmable Gate Array technology, Kluwer Academic publication, 2009.

Reference Books

1. Ian Kuon, Russell Tessier, Jonathan Rose, FPGA Architecture, Now Publishers, 2008.
2. Scott Hauck, André Dehon ,"Reconfigurable computing: the theory and practice of FPGA-based computation", Morgan Kaufmann publishers, 2008.
3. Steve Kilts, *"Advanced FPGA Design: Architecture, Implementation, and Optimization", Wiley Publisher, 2007* .
4. Pong P. Chu, *"FPGA Prototyping by VHDL / Verilog Examples"Wiley Publisher, 2008*
5. D. Pellerin and S. Thibault, Practical FPGA Programming in C, Prentice-Hall, 2005.

Web References

1. http://nptel.iitm.ac.in
2. https://dl.acm.org/doi/book/10.5555/983326
3. https://www.academia.edu/31100712/FPGA-Based_System_Design_Wayne_Wolf_SAmple_book
4. https://www.researchgate.net/publication/268424617_Design_and_Implementation_of_FPGA-Based_Systems_-A_Review
5. https://trove.nla.gov.au/work/38674264

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	-	3	3	-	1	3	3	-
2	2	-	3	3	-	1	3	3	-
3	2	-	3	3	-	1	3	3	-
4	2	-	3	3	-	1	3	3	-
5	2	2	3	3	2	1	3	3	-

Correlation Level: 1-Low, 2-Medium, 3- High

	L	T	P	C	Hrs
P20VEE319 **SOFT COMPUTING**	3	0	0	3	45

Course Objectives
- To understand the fundamental theory and concepts of neural networks, neuro-modelling, several neural network paradigms and its applications.
- To introduce the fuzzy logic concepts, fuzzy principles and relations.
- To learn about genetic algorithm implementation in soft computing.
- To embed fuzzy logic with genetic algorithms for computing.
- To understand different soft computing tools to solve real life problems.

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

CO1 -Explain the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations. **(K2)**

CO2 - Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. **(K3)**

CO3 - Apply genetic algorithms to combinatorial optimization problems. **(K3)**

CO4 - Design hybrid system to revise the principles of soft computing in various applications. **(K3)**

CO5 - Apply modern software tools to solve real problems using a soft computing approach and evaluate various soft computing approaches for a given problem. **(K3)**

UNIT I NEURAL NETWORK **(9 Hrs)**
Basic concept - mathematical model - properties of neural networks - architectures - different learning methods - common activation functions - application of neural networks; Neuron architecture: Algorithms - McCullo h-Pitts - Back propagation NN - ADALINE - MADALINE - Discrete Hopfield net - BAM - Maxnet..

UNIT II FUZZY SETS & LOGIC **(9 Hrs)**
Fuzzy versus Crisp - fuzzy sets - fuzzy relations - laws of propositional logic - inference - Predicate logic fuzzy logic - quantifiers - inference - defuzzification methods.

UNIT III GENETIC ALGORITHM **(9 Hrs)**
Role of GA - fitness function - selection of initial population - cross over (different types) - mutation - inversion - deletion - constraints handling and applications of travelling salesman and graph coloring.

UNIT IV HYBRID SYSTEMS **(9 Hrs)**
Hybrid Systems: GA based BPNN (Weight determination) - Neuro fuzzy systems - Fuzzy BPNN - fuzzy neuron - architecture - learning - Fuzzy logic controlled genetic algorithm

UNIT V INSTRUCTIONAL ACTIVITY **(9 Hrs)**
Simulation of PSD - HSA and ACO related to either wireless networking or Antenna or Image Processing using related tools.

Text Books
1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", 2nd Edition, John Wiley India, 2012.
2. S. Haykin, "Neural Networks - A Comprehensive Foundation", 2nd Edition, Pearson Education, 2005.
3. T.S. Rajasekaran, G.A. VijaylakshmiPai, "Neural Networks, Fuzzy Logic & Genetic Algorithms – Synthesis and Applications", Prentice-Hall India, 2003.

Reference Books
1. Goldberg David, "Genetic Algorithms", Pearson Education, 2006.
2. J.-S. R. Jang, C.-T. Sun, and E. Mizutani , "Neuro-Fuzzy and soft Computing" , PHI Learning, 2009.
3. Simon Haykin , "Neural Networks and Learning Machines", 3rd edition , PHI Learning, 2011.
4. Timothy J. Ross ,"Fuzzy Logic with Engineering Applications", 3rd Edn. , Willey, 2010.
5. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning Pearson Education India, 2013

Web References

1. http://www.vssut.ac.in/lecture_notes/lecture1423723637.pdf
2. https://lecturenotes.in/subject/124/soft-computing-sc
3. https://nptel.ac.in/courses/106/105/106105173/
4. https://sites.google.com/site/7csesoftcomputing/course/lecture-note
5. https://www.tutorialspoint.com/fuzzy_logic/index.htm

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	-	3	3	1	1	3	-	2
2	2	-	3	3	1	1	3	-	2
3	2	-	3	3	1	1	3	-	2
4	2	-	3	3	1	1	3	-	2
5	2	2	3	3	2	1	3	-	2

Correlation Level: 1-Low, 2-Medium, 3- High