TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institute

DEPARTMENT OFELECTRONICS & COMMUNICATION ENGINEERING

B.Tech. Electronics & Communication Engineering

Syllabus

From

Academic Year 2022-23

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur) Programme: Electronics & Communication Engineering

Scheme of Instructions: Third Year B.Tech. in Electronics & Communication Engineering

Semester – VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits	EXAM SCHEME				
									CT1	CT2	TA/CA	ESE	TOTAL
1	PCC	BEC3601	Internet of Things	3	-	-	3	3	15	15	10	60	100
2	PCC	BEC3602	Digital Image Processing	3	-	-	3	3	15	15	10	60	100
3	PEC	BEC3603-05	Program Elective-III	3	-	-	3	3	15	15	10	60	100
4	PEC	BEC3606-08	Program Elective-IV	3	-	-	3	3	15	15	10	60	100
5	OEC	B$$XX01-16	Open Elective –II	3	-	-	3	3	15	15	10	60	100
6	PCC	BEC3609	Internet of Things Lab	-	-	2	2	1	-	-	25	25	50
7	PCC	BEC3610	Digital Image Processing Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	BEC3611	Software Simulation Lab (NS2,Lab View, MATLAB)	-	-	2	2	1	-	-	25	25	50
9	PROJ	BEC3612	Mini Project#	-	-	2	2	2	-	-	50	50	100
10	MCC	AU3612	Social Awareness	2	-	-	2	Audit	-	-	-	-	-
			Total	**17**	**-**	**08**	**25**	**20**	**75**	**75**	**175**	**425**	**750**

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core Courses)	PEC (Programme Elective Courses)	OEC (Open Elective courses from other discipline)	Project / Seminar /Industrial Training	MCC (Mandatory Courses)
Credits	--	--	--	11	04	06	00	Yes
Cumulative Sum	05	24	24	38	06	03	02	--

PROGRESSIVE TOTAL CREDITS : 102+21 =123

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Program Elective- I	Program Elective- II	Program Elective- III
Semester V	**Semester V**	**Semester VI**
BEC3506 Digital System Design	**BEC3509** Introduction to MEMS	**BEC3603** Antenna and Microwave Engineering
BEC3507 Embedded Systems	**BEC3510** Information Theory and Coding	**BEC3604** Optical Communication
BEC3508 Power Electronics	**BEC3511** Biomedical Instrumentation	**BEC3605** Mechatronics
Program Elective-IV	**Program Elective-V**	
Semester VI	**Semester VII**	
BEC3606 PLC SCADA	**BEC4703** Robotics & Automation	
BEC3607 Wireless & Sensor Network	**BEC4704** Machine learning	
BEC3608 Speech Processing	**BEC4705** Satellite Communication	

List of Open Elective

Sr. No.	Course Code	Course Title	Sr. No.	Course Code	Course Title
1	BCSXX01	Cyber Law and Ethics	9	BMEXX09	Nanotechnology and Surface Engineering
2	BCSXX02	Block chain Technology	10	BMEXX10	Automobile Engineering
3	BITXX03	Cyber Security	11	BEEXX11	Power Plant System
4	BITXX04	Artificial Intelligence	12	BEEXX12	Electrical Materials
5	BECXX05	Internet of Things	13	BAEXX13	Avionics
6	BECXX06	Embedded Systems	14	BAEXX14	Unmanned Aerial Vehicles
7	BCEXX07	Introduction to Art and Aesthetics	15	BBTXX15	Biomaterials
8	BCEXX08	Metro Systems and Engineering	16	BBTXX16	Food and Nutrition Technology

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3601 : Internet of Things and its Applications

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	1 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

Categorize Embedded Systems by using memory architecture and Processor.
Analyze IoT and its architecture.
Distinguish between IoT and M2M.
Analyze Communication Protocols and Sensor Networks.
Review the applications of industrial IoT.

Course Contents

Unit I	**Introduction to IoT and Architecture** :- IoT definition & Characteristics, Advantages and disadvantages, IoT functional blocks, sensing , actuation , Physical Design of IoT, Logical design of IoT, Constraints affecting design in IoT. Introduction, Functional View, Information View, Deployment and Operational view, Other relevant architectural views**.**
Unit II	**M2M to IOT:-** Introduction, Basic Concepts, Difference between IoT and M2M, M2M Value Chains, IoT Value Chains, Machine to Machine Communication, M2M to IoT-Architecture, Design principles and capabilities.
Unit III	**Network and Communication Aspects:-** Wireless medium access issues, MAC protocol, Communication Protocols: ZigBee, 6 LoWPAN, Bluetooth NFC and RFID , Sensor deployment & Node discovery.
Unit IV	**IoT Applications :-** Intelligent Traffic systems, Smart Parking , Health Care and Agriculture.
Unit V	**IoT Case Studies :-** Smart Cities, Health Care, Automotive, Agriculture, Logistics

Text Books

1	Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015 .
2	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
3	Introduction to IoT by Sudip Mishra, Anandrup Mukherjee, Arijit Roy. Publisher : Cambridge University Press
4	Internet of Things Architecture and Design Principles by Rajkamal. Publisher : McGraw Hill Education (India) Pvt. Ltd.

Reference Books

1	Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
2	Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key

	applications and Protocols‖, Wiley, 2012
3	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, 1st Edition, Apress Publications, 2013
Useful Links	
1	https://archive.nptel.ac.in/courses/106/105/106105166/
2	https://onlinecourses.nptel.ac.in/noc23_cs82/preview
3	

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Third Year(Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3602: Digital Image Processing

TeachingScheme	
Lectures	3Hrs/week
Tutorial	0Hrs/week
TotalCredit	3

ExaminationScheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs00Min.	

Course Outcomes (CO)

Studentswill beableto

Understand the basic principle of image processing image sampling and quantization ,Pixel, RGB
Describe the spatial domain and frequency domain, Smoothing and Sharpening frequency domain.
Analyze Image Restoration Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering
Examine Edge detection, Edge linking and Hough transform.
Illustrate data compression using Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG – MPEG standard

Course Contents

Unit I	**Steps in Digital Image Processing** – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT.
Unit II	**Spatial Domain**: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.
Unit III	**Image Restoration** - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering
Unit IV	**Edge detection**, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheld.
Unit V	**Need for data compression**, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG.

TextBooks

T.1	Fundamentals of Digital Image Processing-A.K. Jain,PHI,1989
T.2	Digital Image Processing- Rafeal C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
T.3	Image Processing The Fundamentals By Wiley, 2nd Edition,2010

ReferenceBooks

R.1	John Twidell, " Renewable Energy Soources", Routledge, Fourth Edition

R.2	Muhammad Rashed Al Mamun, “Utilization of Biomass for supply of renewable energy in rural area.”, Springer 1st Edition
R.3	Dan Bahadur Pal, Pardeep Singh, “Utilization of Waste Biomass in Energy, Environment and Catalysis”, CRC Press, 1st Edition
UsefulLinks	
1	https://onlinecourses.nptel.ac.in/
2	https://nptel.ac.in/courses/117105079

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3603 : Antenna and Microwave Engineering

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

Evaluate the antenna parameters and link power budgets
Design and assess the performance of various antennas
Examine communication reliability using the gain of arrays antenna
Analyze blocks of microwave circuits and systems using passive and active microwave devices
Design a microwave system given the application specifications

Course Contents

Unit I	**INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS:** Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.
Unit II	**RADIATION MECHANISMS AND DESIGN ASPECTS** Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.
Unit III	**ANTENNA ARRAYS AND APPLICATIONS** Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.
Unit IV	**PASSIVE AND ACTIVE MICROWAVE DEVICES** Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.
Unit V	**MICROWAVE DESIGN PRINCIPLES** Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

Text Books

1	John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006.
2	David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012
Reference Books	
1	Constantine A.Balanis, ―Antenna Theory Analysis and Design‖, Third edition, John Wiley India Pvt Ltd., 2005.
2	R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001
Useful Links	
1	http://www.digimat.in/nptel/courses/video/108101112/L40.html
2	https://archive.nptel.ac.in/courses/108/101/108101112/
3	https://www.youtube.com/watch?v=h51mFbIgZRI

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3604 : Optical Communication

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

Illustrate the basic elements and ray theory of optical fiber
Analyze the transmission characteristics & signal distortion in optical fiber communication
Categorize the types of optical sources & optical receiver operation and its performance
Examine the architecture and components of analog links & Digital links
Determine the working principle of optical network and optical amplifiers used in communication application.

Course Contents

Unit I	**Introduction to Optical Fiber:** Principle of optical fiber communication, Block diagram , Advantages and applications, Ray model, Total internal reflection phenomenon, Acceptance angle, acceptance cone, Numerical aperture. Structures and characteristics of various fibers such as step index, graded index, Single mode and multi mode fibers
Unit II	**Transmission Characteristics of Optical Fibers:** Introduction, Attenuation, absorption, Scattering Losses, bending Losses , dispersion, Intra modal dispersion, Inter modal dispersion, Fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers
Unit III	**Optical Sources:** LED ,Types of LED, LED Power and quantum efficiency. LASER - Principle of operation, Fabry-Perot laser and its properties. **Optical Receivers :** Photo detector - PIN diode, Avalanche Photo detectors, Structures and Properties, Introduction to optical Receiver, its Operation, receiver sensitivity, quantum limit, Eye diagrams, Coherent detection
Unit IV	**Analog and Digital links:** Analog links-Introduction , overview of analog links, RF over fiber, key link parameters, Radio over fiber links, Digital links-Introduction point-to-point links, System considerations, link power budget, Rise time budget
Unit V	**Optical Networks:** WDM concepts, overview of WDM operation principles, WDM standards, Elements of optical networks, SONET/SDH. Optical Interfaces, SONET/SDH Rings and Networks, High speed light wave Links, optical amplifiers , basic applications and types, semiconductor optical amplifiers , EDFA

Text Books	
1	Optical Fiber Communication by Gerd Keiser4th Ed, MGH,2008-1
2	Optical Fiber Communications by John M. Senior Pearson Education, 3rd Impression,2007
Reference Books	
1	Fiber optic communication by Joseph C Palais4th Edition, Pearson Education
2	Textbook on Optical Fiber Communication & Its Application by S.C. Gupta PHI Publication
3	Optical communication & Networks by M.N.Bandopadhyay, PHI Publications
Useful Links	
1	https://youtu.be/K4S9p-mMq3o?si=LSmjgKmVCyv6BEO1
2	https://youtu.be/KIPFP8wke9M?si=3FE5K6Pj6_kzSEBs
3	https://youtu.be/lWC18op2yU8?si=eoP1757HR6tBJmW5

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3605 : Mechatronics

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

Understand the basic principle mechatronics
Analyze basics of sensors and their applications.
Analyze basic principle and applications actuators
Examine the industrial automation .
Study: case study of industry 4.0defence systems automation Electronics.

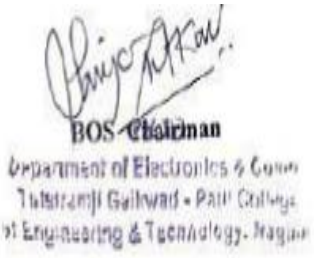
Course Contents

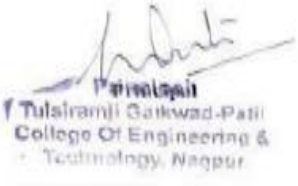
Unit I	INTRODUCTION: Mechatronics key elements, design process and issue modeling process and simulation of physical systems, electrical system, mechanical translation – rotation system eletromechanical system coupling ,ball screw electronics cams, indexing mechanism
Unit II	SENSORS: sensor characteristics and classifications , position sensors, gas sensors, piezoelectric sensor, proximity sensor load cell, accelerometer, gyroscope, inclinometer wearable sensors for robotics application signal conditioning and data conversion
Unit III	ACTUATORS; direct current motor and drive , stepper motor and drives, servomotor, drive, piezoelectric actuators shape memory alloy actuators pneumatics and fluid power actuators power sensation actuators .
Unit IV	INDUSTRIAL AUTOMATION: Industrial revolution, basics components of automation, PLC commissioning and installation , architecture of PLC ,PLC programming advanced instruction of PLC introduction of programmable automation controller (PAC) components and features ,SCADA scripting Graphical animation, PLC networking and communication Introduction to human machine interface.
Unit V	CASE STUDY: Industry 4.0 defense systems ,Automotive Electronics , biomedical systems, agriculture system

Text Books

1	Devdas shetty and Richard Mechatronics system design
2	John Hackworth and F. Hackworth programmable logic controllers

Reference Books	
1	W.Bolton , Mechatronics, pearson education asia
2	Natiigor mahalik, mechatronics principles concepts and application.
Useful Links	
1	https://nptel.ac.in/courses/112103174
2	https://nptel.ac.in/courses/112107298





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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3606: PLC and SCADA

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

1	Categorized PLC configuration using IO Modules
2	Evaluate the physical parameters using PLC
3	Examine the operation of analog and digital devices using PLC programming
4	Execute the advance functions of PLC to control the speed of motors and temperature
5	Analyze the industrial process to control the devices using SCADA

Course Contents

Unit I	**Introduction to PLC:** Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, types –fixed/modular/dedicated, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, selection criterion
Unit II	**Interfacing of PLC with I/O devices: Input** ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices Sensors-temperature, pressure, flow, level Actuators-Electrical, pneumatic, hydraulic Limit switches, proximity sensors Control Elements- Mechanical, Electrical, Fluid valves
Unit III	**Programming of PLC:** Programming languages for PLC, Ladder diagram fundamentals, Rules for proper construction of ladder diagram Timer and counter-types along with timing diagrams, Reset instruction, latch instruction and control zones Developing ladder logic for Sequencing of motors, ON OFF Tank level control, ON OFF temperature control, bottle filling plant, car parking, traffic light controller
Unit IV	**Advance function and Applications of PLC:** Analog PLC operation and PLC analog signal processing, PID principles, Motors Controls: AC motor and DC motor controller, PLC Applications in developing systems- Tank level controller using analog signals, temperature controller using RTD, speed control of electric motor.
Unit V	**Introduction to SCADA:** Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, important definitions HMI, MTU, RTU, communication means, Desirable Properties of SCADA system, advantages, disadvantages and applications of SCADA in Automatic substation control & Water Purification System.

Text Books	
1	John W. Webb, Ronald A. Reis, “Programmable Logic Controllers: Principles and Application”, PHI Learning, New Delhi, 5th Edition
2	John R. Hackworth, Frederick D., Hackworth Jr., “Programmable Logic Controllers Programming Methods and Applications”, PHI Publishers
3	Stuart A Boyer, “SCADA supervisory control and data acquisition”, ISA, 4th Revised edition
Reference Books	
1	Batten G. L., “Programmable Controllers”, McGraw Hill Inc., Second Edition
2	Krishna Kant, “Computer Based Industrial Control”, PHI
3	P. K. Srivstava, “Programmable Logic Controllers with Applications”, BPB Publications
Useful Links	
1	https://www.youtube.com/watch?v=MS3qJq2jvu0
2	https://www.youtube.com/watch?v=UQ16Cous_tY
3	https://www.youtube.com/watch?v=_QbqLOSeYao

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BEC3607: Wireless & Sensor Network

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

Analyze wireless network topologies, infrastructure and ad-hoc networks
Evaluate infrastructure of wireless sensing network.
Apply the constant envelope modulation techniques and analyze.
Estimate the basic principle of capacity and performance of FDMA, TDMA, DS/CDMA and FH/CDMA,WCDMA and OFDMA.
Create and analyze the wireless and cord less loop technology.

Course Contents

Unit I	Wireless network topologies, infrastructure and ad-hoc networks, different generations of wireless networks; The cellular concept and design fundamentals, coverage and capacity expansion techniques.
Unit II	Large scale path loss modeling and shadow fading, indoor and outdoor propagation models; Multipath and Doppler, impulse response model of multipath channel, types of small scale fading, Rayleigh and Ricean fading, simulation model.
Unit III	Constant envelope modulation techniques, GMSK; OQPSK and π/4 QPSK; Spread spectrum modulation and RAKE receiver; OFDM; Performance in fading and multipath channels.
Unit IV	Fixed assignment and random access; Capacity and performance of FDMA, TDMA, DS/CDMA and FH/CDMA; WCDMA and OFDMA; Access techniques for WLAN, Bluetooth and mobile data networks; Quality of service enabled wireless access, access methods for integrated services.
Unit V	Location and handoff management, classification of handoffs and handoff algorithms, mobile IP; Power control, and techniques of 6 25 0 25 50 0 3 3 0power control, power saving mechanisms, energy efficient designs; Security in wireless networks. GSM: Reference architecture, registration, call establishment, handoff mechanisms, communication in the infrastructure, GPRS; IS-95: reference architecture, physical layer, radio resource and mobility management; IMT 2000: Physical layer, handoff, power control; Introduction to cordless systems and wireless local loop technologies.

Text Books

1	Pahalvan, K. and Krishnamurthy, P., "Principles of Wireless Networks: A Unified Approach", Pearson Education.
2	Stallings, W. "Wireless Communications and Networking", Pearson Education.

Reference Books

1	Rappaport, T.S., “Wireless Communications: Principles and Practice”, 2nd Ed., Pearson Education.
2	Prasad, R. and Munoz, L., “WLANs and WPANs: Towards 4G Wireless”, Artech House.
3	Haykin, S. and Moher, M., “Modern Wireless Communication”, Pearson Education
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105160/
2	https://nptel.ac.in/courses/106/105/106105081/
3	https://nptel.ac.in/courses/117/102/117102062/

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Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3608 : Speech Processing

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

Determine speech recognition principles, methods, models and implementation.
Examine speech recognition principles &methods to characterize the speech signal and to recognize the speech.
Analyze the Pattern Comparison Techniques and Hidden Markov Models to recognize the speech.
Examine the speech recognition methods, pattern comparison techniques and Hidden Markov Models.
Examine speech recognition systems using sub word units for efficiency.

Course Contents

Unit I	The Speech Signal: Fundamentals of Speech recognition, the process of speech production and perception in human beings, the speech production process, representing speech in time and frequency domains, speech sounds and features.
Unit II	Signal Processing and Analysis methods for Speech Recognition: Spectral analysis models, The Bank-of-filters front-end processor, Linear predictive coding model for Speech recognition, Vector quantization.
Unit III	Pattern Comparison Techniques: Introduction, Speech detection, Distortion measures- Mathematical considerations, Distortion measures- Perceptual considerations, Spectral distortion measures.
Unit IV	Theory and Implementation of Hidden Markov Models: Introduction, Discrete time Markov processes, Extensions to Hidden Markov models, Three basic problems for HMMs, Types of HMMs, Continuous observation densities in HMMs, comparison of HMMs, Implementation issues for HMMs, HMM system for isolated word recognition.
Unit V	Large Vocabulary continuous speech recognition: Introduction, Sub word speech units, sub word unit models based on HMMs, Training of sub word units, Language models for Large vocabulary speech recognition, Statistical language modeling, Perplexity of the language model, Overall recognition system based on sub word units.

Text Books

1	Lawrence Rabiner and Biing-Hwang Juang, Fundamentals of Speech Recognition, Pearson Education, 2007.
2	L. R. Rabiner and S. W. Schafer, “Digital Processing of Speech Signals”, Pearson Education.
3	Douglas O"Shaughnessy, “Speech Communications: Human & Machine”, 2nd Ed., Wiley India, 2000.

Reference Books

1	Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, Fundamentals of Speech Recognition,

	Pearson Education, 2009.
2	Claudio Becchetti and Lucio Prina Ricotti, Speech Recognition, John Wiley and Sons, 1999.
3	Daniel Jurafsky and James H Martin, Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education, 1 st Ed., 2000.
Useful Links	
1	**https://nptel.ac.in/courses/117105145**
2	https://ocw.mit.edu/courses/6-345-automatic-speech-recognition-spring-2003/
3	https://www.classcentral.com/course/youtube-digital-speech-processing-47859

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3606: Internet of Things Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	25 Marks
Total Credit	1	**ESE**	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

1	**Explain** and describe the basics and architecture details of Internet of Things
2	**Apply** the concept of M2M and compare it with IOT
3	**Summarize** the working of Networking Protocols and communication technologies used in IOT.
4	**Apply** IOT techniques in the field of agriculture ,health care, smart home and smart city
5	**Design** micro project, mini projects using Arduino Uno and Raspberry Pi

Sr. No.	List of Experiment	CO
1	**Demonstrate** Arduino UNO.	CO1
2	**Execute** programming for LED Blink	CO1
3	**Execute** programming for LED Blink with Switch.	CO2
4	**Execute** programming for Buzzer.	CO2
5	**Execute** programming for LCD Display.	CO3
6	**Perform** programming for Bluetooth.	CO3
7	**Prepare** Program for Seven Segment Display.	CO4
8	**Prepare** Program for OLED.	CO4
9	**Create** Program for PIR Sensor.	CO5
10	**Create** Program for Ultrasonic Sensor.	CO5

1	Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press, 2015 .
2	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things‖, Springer, 2011.
3	Introduction to IoT by Sudip Mishra, Anandrup Mukherjee, Arijit Roy. Publisher : Cambridge University Press
4	Internet of Things Architecture and Design Principles by Rajkamal. Publisher : McGraw Hill Education (India) Pvt. Ltd.

Reference Books

1	Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
2	Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2012

3	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, 1st Edition, Apress Publications, 2013
Useful Links	
1	https://archive.nptel.ac.in/courses/106/105/106105166/
2	https://onlinecourses.nptel.ac.in/noc23_cs82/preview

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3607: Digital Image Processing Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	25 Marks
Total Credit	1	**ESE**	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

1	**Examine** Transformations of an Image and Pixel
2	**Analyze** Contrast stretching of a low contrast image,
3	**Evaluate** image sharpening filters and Edge Detection using Gradient Filters
4	**Implement** Image Smoothening Filters(Mean and Median filtering of an Image)
5	**Analyze** image restoring techniques

Sr. No.	List of Experiment	CO
1	Simulate and Display of an Image, Negative of an Image(Binary & Gray Scale)	**CO1**
2	Implement Relationships between Pixels	**CO 1**
3	Implement Transformations of an Image	**CO2**
4	Perform Contrast stretching of a low contrast image, Histogram, and Histogram Equalization	**CO2**
5	Display FFT(1-D & 2-D) of an image	**CO2**
6	Implement image sharpening filters and Edge Detection using Gradient Filters	**CO3**
7	Implement of Image Smoothening Filters(Mean and Median filtering of an Image)	**CO3**
8	Implement image restoring techniques	**CO4**
9	Detect edges in the image.	**CO4**
10	Compress Images by HUFFMAN coding	**CO5**

Text Books

1	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition,

	Pearson Education, 2010.
2	Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
Reference Books	
1	Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
2	Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
Useful Links	
1	https://nptel.ac.in/courses/117105079
2	https://www.youtube.com/watch?v=jD6u0IyXlYc

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BEC3611: Software Simulation Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	25 Marks
Total Credit	1	**ESE**	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

1	**Implement** periodic and a periodic signals and operations on signal
2	**Analyze** parts of signal and its convolution for sequence.
3	**Perform** correlation of signal and sequence with its linearity and properties
4	**Perform** sampling technique for signals and working of basic electrical signals
5	**Design** sequential logic circuits using VHDL.

Sr. No.	List of Experiment	CO
1	Generation of Various signals and sequence (periodic and Aperiodic), such as unit Impulse, Unit Step, Square, Saw tooth, Ramp, Triangular	**CO1**
2	Operation on signal and sequences such as Addition, Multiplication, Scaling, Shifting, Folding	**CO1**
3	Finding the even and odd parts of signal/sequence and real and imaginary parts of signal	**CO2**
4	Convolution for signal and sequence	**CO2**
5	Auto correlation and cross correlation for signals and sequence	**CO3**
6	Verification of linearity and time Invariance properties of a given continuous/Discrete system	**CO3**
7	Verification of sampling code	**CO4**
8	Simulation of basic electrical circuit	**CO4**
9	Implement VHDL code for Counters.	**CO5**
10	Simulate VHDL code for sequence detectors.	**CO5**

Text Books

1	Mazidi Muhammad Ali , “8051 Microcontroller And Embedded Systems : Using Assembly And C”, Pearson Education 2007.
2	Vahid Frank; Givargis Tony, “Embedded System Design”, Wiley India.
3	Signal & Systems by Alan V. Oppenhein,Alan S. Willsy, S.Hamid Nawab

Reference Books

1	James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2	Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2"" Ed. Man Press LLC 2015 ISBN: 0982692633 9780982692639

Useful Links	
1	https://www.youtube.com/watch?v=uFhDGagZzjs
2	https://dituniversity.digimat.in/nptel/courses/video/106105193/L28.html

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Third Year (Semester-VI) B.Tech. Electronics & Communication Engineering

BEC3606: PLC and SCADA

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

1	Categorized PLC configuration using IO Modules
2	Evaluate the physical parameters using PLC
3	Examine the operation of analog and digital devices using PLC programming
4	Execute the advance functions of PLC to control the speed of motors and temperature
5	Analyze the industrial process to control the devices using SCADA

Course Contents

Unit I	**Introduction to PLC:** Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, types –fixed/modular/dedicated, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, selection criterion
Unit II	**Interfacing of PLC with I/O devices: Input** ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices Sensors-temperature, pressure, flow, level Actuators-Electrical, pneumatic, hydraulic Limit switches, proximity sensors Control Elements- Mechanical, Electrical, Fluid valves
Unit III	**Programming of PLC:** Programming languages for PLC, Ladder diagram fundamentals, Rules for proper construction of ladder diagram Timer and counter-types along with timing diagrams, Reset instruction, latch instruction and control zones Developing ladder logic for Sequencing of motors, ON OFF Tank level control, ON OFF temperature control, bottle filling plant, car parking, traffic light controller

Unit IV	**Advance function and Applications of PLC:** Analog PLC operation and PLC analog signal processing, PID principles, Motors Controls: AC motor and DC motor controller, PLC Applications in developing systems- Tank level controller using analog signals, temperature controller using RTD, speed control of electric motor.
Unit V	**Introduction to SCADA:** Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, important definitions HMI, MTU, RTU, communication means, Desirable Properties of SCADA system, advantages, disadvantages and applications of SCADA in Automatic substation control & Water Purification System.

Text Books	
1	John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition
2	John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers
3	Stuart A Boyer, "SCADA supervisory control and data acquisition", ISA, 4th Revised edition
Reference Books	
1	Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition
2	Krishna Kant, "Computer Based Industrial Control", PHI
3	P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications
Useful Links	
1	https://www.youtube.com/watch?v=MS3qJq2jvu0
2	https://www.youtube.com/watch?v=UQ16Cous_tY
3	https://www.youtube.com/watch?v=_QbqLOSeYao

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