B.Sc., Electronics and Communication

Allied

<table>
<tr><td>Title of the Course</td><td colspan="7">Electronic Measurements and Instruments</td></tr>
<tr><td>Paper No.</td><td colspan="7">Allied – I A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective (Allied)</td><td>Year</td><td>I</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BECA1</td></tr>
<tr><td>Semester</td><td>I</td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td></td><td>3</td><td>1</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">➢ To learn about digital instruments
➢ To familiarize in R, L,C measurements
➢ To familiarize in oscilloscopes and function generators
➢ To get knowledge in analyzing instruments</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>45 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">DIGITAL INSTRUMENTS</td><td>9 hrs</td></tr>
<tr><td colspan="7">Digital Instruments basics – Digital displays – Digital counters – ADC and DAC – DigitalVoltmeter – Digital Multimeter – Digital Frequency meter – Frequency meter accuracy – Time and ratio measurements.</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">R, L AND C MEASUREMENTS</td><td>9 hrs</td></tr>
<tr><td colspan="7">Low, High and Precise Resistance Measurements – Voltmeter and Ammeter methods – Substitution method – Wheatstone Bridge – Low, High and Precise measurement methods– AC bridge theory – Capacitance bridges – Inductance bridges – Multi function Impedance bridge – Digital R, C, L measurements – Digital LCR meter – Q meter.</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">OSCILLOSCOPES</td><td>9 hrs</td></tr>
<tr><td colspan="7">CRT – Dual trace Oscilloscopes – Voltage, frequency and phase measurements – Analog storage oscilloscopes – Digital storage oscilloscopes – Sampling oscilloscopes.</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">SIGNAL GENERATORS</td><td>9 hrs</td></tr>
<tr><td colspan="7">Low frequency signal generators – Function generators – Pulse generators – Sweepfrequency generators – RF signal generators – Frequency synthesizer – Arbitrary waveform generator – DSO applications – Representative DSO</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">RECORDING AND WAVEFORM ANALYZING INSTRUMENTS</td><td>9 hrs</td></tr>
<tr><td colspan="7">Strip chart recorders – X-Y Plotters – Plotting device characteristics – Plotter – Digital waveform recorder / analyzer – Distortion meter – Spectrum analyzer – Digital spectrum analyzer – waveform analyzing instruments</td></tr>
<tr><td>Text Books</td><td colspan="7">1. David A.Bell,(2003), “Electronic measurements and Instruments”, Prentice Hall of India, 2/e,.
2. R.S. Sedha, “Electronic measurements and Instrumentation”. Chand
3. H. S. Kalsi, “Electronic Instrumentation”, TMH(2006)</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Alan S Morris, (2001) “Measurement and Instrumentation Principles”, 3rdEdition, Butterworth- Heinemann.
2. J P Navani, “Electronic Measurement and Instrumentation”, S Chand</td></tr>
<tr><td></td><td colspan="7">Publications
3. A.K. Sawhney,(2015), “A Course in Electronic Measurements and Instrumentation”, Dhanpat Rai & Co.,</td></tr>
</table>

Web Resources	1. https://archive.nptel.ac.in/courses/108/105/108105153/ 2. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

COURSE OUTCOMES:
On successful completion of the course students will be able to:

Course Outcomes	CO1	To use digital displays, counters and meters
	CO2	To explain the principles of AC/DC bridges and their measurements
	CO3	To recognize the applications of oscilloscopes in measurements
	CO4	To handle function generators for waveform generation
	CO5	To study the outputs of waveform/spectrum analyzer

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):
STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	M	L	S	M
CO2	S	S	M	S	S	M	L
CO3	M	S	M	S	S	S	S
CO4	S	M	S	M	S	S	L
CO5	M	S	S	M	S	S	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	2	3	3	2
CO3	2	3	3	2	3
CO4	3	3	2	3	2
CO5	3	2	3	2	3
Weightage	14	13	13	13	12
Weighted Percentage of Course Contribution to PSOs	2.8	2.6	2.6	2.6	2.4

Title of the Course	**Electronic Measurements Lab**						
Paper No.	**Allied Practical – IA**						
Category	**Generic Elective (Allied)**	**Year**	**II**	**Credits**	**2**	**Course Code**	23BECAP1
		Semester	**IV**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	-	-	**2**		**3**		
Objectives of the course	➢ To familiarize various measuring devices ➢ To familiarize measuring circuits using Op-amps ➢ To study various bridge circuits						
Course Details							**30 hrs**

Any 8 Experiments

1. Use of function generator to generate different types of waveforms
2. Use of DSO to measure amplitude and frequency
3. Measurement of phase and frequency using Lissajou's figure in CRO
4. ADC using Op-amp
5. DAC using Op-amp
6. Instrumentation amplifier
7. Determination of impact of filter on rise time and fall time of pulses
8. Measurement of resistance using Kelvin's double bridge
9. Measurement of resistance using Wheatstone bridge
10. Measurement of inductance using Maxwell's bridge
11. Measurement of inductance using Hay's bridge
12. Measurement of capacitance using Schering bridge
13. Measurement of capacitance using Desauty's bridge
14. Determine high resistance by Megohm Bridge method

Text Books	1. R.K. Rajput, "Electrical and Electronic Measurements and Instrumentation", S. Chand, 2008
Reference Books	1. Syed Akhtar Imam, Vibhav Kumar Sachan, (2020), "Electronic Measurement and Instrumentation", Wiley.
Web Resources	1. http://vlabs.iitkgp.ac.in/asnm/exp17/index.html 2. https://www.studocu.com/in/document/indian-institute-of-technology-kharagpur/electrical-technology/l-44gdret-ee-nptel/28440407

COURSE OUTCOMES:
On successful completion of the course students will be able:

Course Outcomes	CO1	To generate various waveforms of desired frequency using AFO
	CO2	To measure various parameters using CRO, DSO
	CO3	To implement ADC and DAC using Op-amp and verify their output
	CO4	To construct DC bridge circuits and measure capacitance, resistance and inductance
	CO5	To design AC bridge circuits and measure capacitance, resistance and inductance

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	S
CO2	M	S	S	S	M	S	S
CO3	S	M	S	L	S	M	M
CO4	S	S	M	M	S	S	L
CO5	S	S	L	M	M	S	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	2	3	3	3	2
CO3	3	2	3	3	3
CO4	3	3	3	2	3
CO5	3	3	2	3	2
Weightage	14	14	13	14	13
Weighted Percentage of Course Contribution to PSOs	2.8	2.8	2.6	2.8	2.6

Title of the Course	**Microprocessors and Microcontrollers**						
Paper No.	**Allied – IB**						
Category	**Generic Elective (Allied)**	**Year**	**I**	**Credits**	**3**	**Course Code**	23BECA2
		Semester	**I**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	3	**-**	**-**		**3**		
Objectives of the course	➢ To get fundamental knowledge in microprocessor 8085 ➢ To learn assembly language programming concepts ➢ To know interfacing techniques ➢ To familiarize with microcontroller 8051 and its applications						
Units	**Course Details**						**45 hrs**
Unit-I	**8085 Architecture and Instructions**						**9 hrs**
	Introduction to INTEL8085 - Register structure - Pin details and functions - Instructioncycle - Timing diagram - Instruction set - Addressing modes – Status flags - Data transfer group - Arithmetic group - Logical group - Branch- Stack, I/O and machine control group.						
Unit-II	**Programming of 8085 Microprocessor**						**9 hr**
	Instruction format and addressing modes – Assembly language format – Data transfer, Data transfer instructions Arithmetic instructions-logical instructions– Programming: Looping, counting & indexing						
Unit-III	**8085 Interfacing**						**9 hrs**
	Block Diagrams – Programming 8255 A – Programming 8257 – programming 8259 – Programming 8253 – Programming 8279 - ADC/DAC interfacing – 8237 Direct Memory Access Controller						
Unit-IV	**8051 Microcontroller**						**9 hrs**
	Features of 8051–Pin description of 8051 - 8051 Microcontroller Architecture - 8051 oscillator and clocks - Program counter and data pointer – A and B Registers – Bank Registers -Flags –PSW - Internal RAM - Stack and Stack pointer - special Function Registers-Memory organization - I/O Port – Interrupt – Timer and Counter – Serial I/O Port.						
Unit-V	**Programming of 8051**						**9 hrs**
	8051 instruction set – Addressing modes–Assembly language programming– I/O port programming–Timer and counterprogramming –Serial communication – Interrupt programming – Interfacing with 8051: ADC, DAC and Stepper motor.						
Text Books	1. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and application with 8085", 5th Edition, PHI, 2002 2. Ram. B, "Fundamentals of microprocessor and microcomputers",Dhanpat Rai &Sons, 2012 3. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller andEmbedded Systems", Pearson Education Asia, 2003						
Reference Books	1. Rafiquzhman. M, "Microprocessors Theory and Applications: Intel and Motorola", PHI Pvt.Ltd., 2003 2. Kenneth. J. Ayala, "The 8051 Microcontroller Architecture Programming andApplication",2nd Edition, Penram International Publishers (India), 1996						
	3. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice – Hall of India, New Delhi, 2007						
Web Resources	1. https://nptel.ac.in/courses/106/108/106108100/ 2. https://archive.nptel.ac.in/courses/108/105/108105102/ 3. https://nptel.ac.in/courses/117104072						

COURSE OUTCOMES:
On successful completion of the course students will be able

Course Outcomes	CO1	To define architecture, addressing modes and instruction set in 8085
	CO2	To explain assembly language programming in 8085
	CO3	To discuss 8255, 8279, 8253, 8259 and 8237 interfacing
	CO4	To describe microcontroller 8051 architecture and pin configuration
	CO5	To understand programming and interfacing in 8051

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	M	S	S	M	S	L	S
CO3	S	M	M	S	S	M	L
CO4	S	S	M	L	S	S	M
CO5	M	M	S	M	L	S	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	2	3	3	2	3
CO4	3	2	3	2	3
CO5	3	3	2	2	2
Weightage	14	13	14	11	12
Weighted Percentage of Course Contribution to PSOs	2.8	2.6	2.8	2.2	2.4

<table>
<tr><td>Title of the Course</td><td colspan="7">Microprocessor/Microcontroller Lab</td></tr>
<tr><td>Paper No.</td><td colspan="7">Allied Practical – IB</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective (Allied)</td><td>Year</td><td>II</td><td>Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23BECAP2</td></tr>
<tr><td>Semester</td><td>IV</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">2</td><td colspan="3">2</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To write simple arithmetic programs in 8085
➢ To write simple programs in 8051
➢ To write programs to interface ADC, DAC, Stepper motor etc.</td></tr>
<tr><td colspan="6">Course Details</td><td colspan="2">30 hrs</td></tr>
<tr><td colspan="8">Any 8 Experiments
1. Addition of 8 / 16 bit Data using 8085
2. Subtraction of 8 / 16 bit Data using 8085
3. Multiplication of 8 bit Data using 8085
4. Division of 8 bit Data using 8085
5. Smallest / largest of N Numbers
6. To arrange in ascending / Descending Order
7. Addition of 8 / 16 bit Data using 8051
8. Subtraction of 8 / 16 bit Data using 8051
9. Multiplication of 8 bit Data using 8051
10. Division of 8 bit Data using 8051
11. Logical operations using 8051
12. ADC Interfacing
13. DAC Interfacing
14. Stepper Motor interfacing</td></tr>
<tr><td>Text Books</td><td colspan="7">1. V. Vijayendran, “Fundamental of Microprocessor 8085: Architecture Programming,and Interfacing”, 2009.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. A. Nagoor Kani, “Microprocessor and Microcontroller”, McGraw Hill Education,2016</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://people.iitism.ac.in/~download/lab%20manuals/electrical/UG_06_EEC375%2020Microprocessor%20and%20Microcontroller%20Laboratory%20Manual.pdf
2. https://nptel.ac.in/courses/117104072</td></tr>
</table>

COURSE OUTCOMES:
On successful completion of the course students will be able

Course Outcomes	CO1	To write basic programs in microprocessor 8085
	CO2	To execute and verify the outputs of elementary programs in
	CO3	To write basic programs using arithmetic and logical instructions
	CO4	To execute and verify the outputs of elementary programs in 8051
	CO5	To interface and verify the performance of ADC/DAC/ Stepper motor

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	M	S
CO2	M	S	S	S	M	L	M
CO3	L	S	S	M	M	M	M
CO4	S	S	M	M	S	S	S
CO5	S	M	S	S	M	S	L

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	2	2
CO3	3	2	2	2	3
CO4	2	3	2	3	3
CO5	3	2	3	3	2
Weightage	14	13	13	12	12
Weighted Percentage of Course Contribution to PSOs	2.8	2.6	2.6	2.4	2.4

Title of the Course	**Communication System**						
Paper No.	**Allied – II - A**						
Category	**Generic Elective (Allied)**	**Year**	**I**	**Credits**	**3**	**Course Code**	23BECA3
		Semester	**I**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	3	**-**	**-**		**3**		
Objectives of the course	➢ To learn various modulation techniques in communication ➢ To be aware of working of domestic electronic appliances. ➢ To get knowledge in radio communication systems						
Units	**Course Details**						**45 hrs**
Unit-I	**Amplitude Modulation**						**9 hrs**
	Sources of Noise – Classification of Noise – External and Internal Noises – Signal Noise Ratio – Amplitude Modulation – Expression - Different forms of Amplitude Modulation – DSBSC – SSB techniques – Transmitters – Types – AM Modulators – Demodulation – AM Detectors – Receivers						
Unit-II	**Frequency and Phase Modulation**						**9 hrs**
	Frequency Modulation – Expression of FM wave – Pre- Emphasis and De-Emphasis – FM Versus AM - FM Generation – Methods of FM generation – Reactance Modulator - FM transmitters – Direct / indirect FM transmitter – Demodulation – FM Receivers – Phase Modulation – Expression – Generation, Transmission and Reception – Comparison of AM, FM and PM.						
Unit-III	**Pulse Modulation**						**9 hrs**
	Pulse Modulation – Quantization – Sampling – Sampling Techniques - Classification - PAM, PTM, PWM, PPM – A/D signals – Principle of Digital communication – Types of Digital Pulse Modulators – PCM – DM – Digital Carrier Modulation – ASK, FSK – Multiplexing – Transmission and Reception of TDM, FDM.						
Unit-IV	**Domestic Electronics**						**9 hrs**
	Antenna – Antenna Reciprocity – Antenna as a Transmission Line – Related Terms – Types UHF & MW – Special Antennas – Colour Television – Primary, Secondary and Complementary Colours – Colour TV Receiver – Camera – Picture Tube – Gun Colour – Screens – Transmission – Reception – Receiver – Flat Panel TV – 3 DTV – LCD / LED TV Plasma TV – TV Studio - Cable TV – CATV Trough Internet – DTH – Merits						
Unit-V	**Radio Communication Systems**						**9 hrs**
	Radar – Principles – Functions – Classification – Pulse Radar – MTI Radar – Beacon Radar– CW Radar – Tracking Radar – Laser Radar – Radar Displays – Satellite Communication – Classification – Related Terms – Antenna Beam Width and Size – Satellite Communication System – earth Station – Satellite Station.						
Text Books	1. M.L.Anand, "Principles of Communication Engineering", CRC Press, 2022. 2. Herbert Taub and Donald L Schilling., "Principles of Communication Systems", 4th Edition, TMH, Fourth reprint 2015.						

Reference Books	1. George Kennedy, Bernard Davis, S. R. M Prasanna, "Electronic Communication Systems", McGraw Hill Education, 2017. 2. Simon Haykin and Michael Moher, "Communication Systems", 5th edition, John wiley& Sons. 3. Wayne Tomasi,"Advanced Electronic Communication Systems",6thEdition, Pearson Education
Web Resources	1. https://archive.nptel.ac.in/courses/117/105/117105144/ 2. https://archive.nptel.ac.in/courses/117/103/117103063/ 3. https://archive.nptel.ac.in/courses/117/102/117102059/

COURSE OUTCOMES:
On successful completion of the course students will be able

Course Outcomes	CO1	To understand AM principle, transmission and detection
	CO2	To discuss frequency modulation and demodulation techniques
	CO3	To analyze phase modulation, demodulation and PAM
	CO4	To describe electronic appliances like antenna, colour TV, cable
	CO5	To realize the principles of radar and satellite communication

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	L	M
CO2	M	M	S	S	S	M	S
CO3	M	S	S	M	S	S	L
CO4	S	S	M	S	M	S	M
CO5	S	M	M	L	L	M	S

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	2	3	2	3
CO3	3	3	2	2	1
CO4	2	2	3	1	2
CO5	3	2	2	3	3
Weightage	14	12	12	11	11
Weighted Percentage of Course Contribution to PSOs	2.8	2.4	2.4	2.2	2.2

<table>
<tr><td>Title of the Course</td><td colspan="7">Communication System Lab</td></tr>
<tr><td>Paper No.</td><td colspan="7">Allied Practical – II A</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective (Allied)</td><td>Year</td><td>II</td><td>Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23BECAP3</td></tr>
<tr><td>Semester</td><td>IV</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">2</td><td colspan="3">3</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To design modulation and demodulation circuits
➢ To construct shift keying modulation and demodulation circuits</td></tr>
<tr><td colspan="7">Course Details</td><td>30 hrs</td></tr>
<tr><td colspan="8">Any 8 Experiments
1. Amplitude Modulation
2. Amplitude De Modulation
3. Frequency Modulation
4. Frequency Demodulation
5. Pulse Position Modulation
6. Pulse Amplitude Modulation
7. Pulse Width Modulation
8. Amplitude Shift Keying Modulation
9. Amplitude Shift Keying Demodulation
10. Frequency Shift Keying Modulation
11. Frequency Shift Keying Demodulation
12. Frequency Division Multiplexing
13. Time Division Multiplexing
14. Pre Emphasis and De-emphasis</td></tr>
<tr><td>Text Books</td><td colspan="7">1. B Sasikala & S Poornachandra Rao, “Handbook of Experiments in Electronics andCommunication Engineering”, 1/e, Vikas Publishing,</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Kennedy Davis, “ Electronic Communication System”, Tata Mc Graw Hill, 4th Edition</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://nptel.ac.in/courses/106106097</td></tr>
</table>

COURSE OUTCOMES:
On successful completion of the course students will be able

Course Outcomes	CO1	To implement modulation and demodulation circuits using ICs
	CO2	To analyse the performance modulation and demodulation circuits
	CO3	To implement shift keying modulation and demodulation experiments
	CO4	To analyze the performance of shift keying modulation and demodulation experiments
	CO5	To demonstrate the performance of Pre Emphasis and De-emphasis

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	S	S	M	M
CO2	S	S	M	M	S	S	L
CO3	S	S	M	S	M	L	S
CO4	M	M	S	M	S	S	M
CO5	M	S	L	M	L	S	S

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2
CO2	3	3	3	2	3
CO3	2	3	2	2	2
CO4	3	2	3	3	2
CO5	2	3	2	1	2
Weightage	13	13	12	11	11
Weighted Percentage of Course Contribution to PSOs	2.6	2.6	2.4	2.2	2.2

Title of the Course	**Internet of Things and its Applications**						
Paper No.	**Allied – II B**						
Category	**Generic Elective (Allied)**	**Year**	**II**	**Credits**	**3**	**Course Code**	23BECA4
		Semester	**IV**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	3	**-**	**-**		**3**		
Objectives of the course	➢ To familiarize with the basics of IoT ➢ To learn technologies and protocols in IoT ➢ To study communication protocols in IoT ➢ To get knowledge in development tools and security of IoT						
Units	**Course Details**						**45 hrs**
Unit-I	**Overview of IoT**						**9 hrs**
	Advantages and Disadvantages of IOT – Characteristics of IOT Working and implementation of IOT – Components of IOT system – IOT architectures and levels – IOT Eco system – Value chain and Global value chain – Types of networks						
Unit-II	**IoT Technologies and Protocols**						**9 hrs**
	Bluetooth – BLE –Wifi – Low power wifi - LiFi – Cellular networks – Z-Wave – RFID – X-10 – Sigfox – Zigbee – Low Range Wide Area Network – 6LoWpan – 5G – Low Power Wide Area Networks – Thread – Near Field Communications – GSM – GPRS – LTE-A –Wireless Sensor Network						
Unit-III	**Communication Protocols**						**9 hrs**
	Application Layer Protocols – Transport Layer Protocols – Network Layer Protocols – Link Layer Protocols – IOT Enabling technologies – Building blocks of IOT – Logical and Physical design of IOT – Design methodology – Communication models						
Unit-IV	**Development Tools of IoT**						**9 hrs**
	Various tools used in IOT – Introduction to Arduino – Types of Arduino boards –Introduction to Arduino IDE – Compiling, debugging, uploading and running a file						
Unit-V	**Security and Future of IoT**						**9 hrs**
	Security – Cyber Security – Need, types and challenges – Privacy for IOT enabled devices– Major IOT leaks – Security for consumer devices – Security levels – Protecting IOT Devices – Future of IOT Ecosystem – Cryptography – Artificial Intelligence - Machine learning.						
Text Books	1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015. 2. Sathish Jain and Shashi Singh, "Internet of Things and its Applications: Made simple", BPB Publishers, 2020. 3. Simone Cirani, Gianluigi Ferrari, Marco Picone, "Internet of Things Architectures, Protocols and Standards", Wiley, 2019.						
Reference Books	1. David Hanes, G. Salgueiro, P. Grossetete, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017. 2. Sachi Nandan Mohanty, Jyotir Moy Chatterjee, Suneeta Satpathy "Internet of Things and Its Applications", Springer, 2022.						
	3. B.K. Tripathy, J. Anuradha "INTERNET OF THINGS (IoT)-Technologies, Applications, Challenges, and Solutions", Taylor & Francis, 2018						

Web Resources	1. https://archive.nptel.ac.in/courses/106/105/106105166/

COURSE OUTCOMES:

On successful completion of the course students will be able

Course Outcomes	CO1	To understand architecture, components and characteristics of IoT
	CO2	To analyze IoT technologies - wifi, lifi, GSM, GPRS, wireless sensor network
	CO3	To realize communication protocols in IoT
	CO4	To describe Arduino types, boards and compiling
	CO5	To discuss security and IoT in cryptography, AI and ML

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	L	L
CO2	S	L	S	M	L	M	S
CO3	S	M	M	S	M	S	M
CO4	S	M	S	S	M	S	S
CO5	S	S	M	S	S	S	S

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	2	3
CO2	3	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	2
Weightage	14	15	12	14	13
Weighted Percentage of Course Contribution to PSOs	2.8	3	2.4	2.8	2.6

Title of the Course	**IoT Applications Lab**						
Paper No.	**Allied Practical – II B**						
Category	**GenericElective (Allied)**	**Year**	**II**	**Credits**	**2**	**Course Code**	23BECAP4
		Semester	**IV**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	-	**-**	**2**		**3**		
Objectives of the course	➢ To program Arduino to control lights, motors, and other devices ➢ To test, debug, and deploy the Arduino to solve real world problems						
Course Details							**30 hrs**

Any 8 Experiments

1. Arduino software installation
2. Design of digital DC voltmeter and Ammeter
3. Interface LED / Buzzer with Arduino
4. Interface IR / LDR sensor with Arduino
5. Interface temperature sensor with Arduino
6. Interface humidity sensor with Arduino
7. Interface motor using relay Arduino
8. Controlling domestic appliances using Arduino
9. Remote monitoring using Arduino
10. Interface blue tooth with Arduino
11. Storing and retrieving data from cloud with Arduino

Text Books	1. Adeel Javed, "Building Arduino Projects for the Internet of Things", Apress,2016
Web Resources	1. https://www.ee.iitkgp.ac.in 2. https://www.citchennai.edu.in 3. https://www.deltaww.com

COURSE OUTCOMES:

On successful completion of the course students will be able

Course Outcomes	CO1	To install Arduino software
	CO2	To design Arduino based digital meters for measurements
	CO3	To interface LED/LDR/Sensor with Arduino
	CO4	To interface and control domestic appliances using IoT
	CO5	To interface cloud based devices using Arduino

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	S	S	S	S	S
CO2	S	M	M	S	L	S	S
CO3	S	S	S	M	M	M	L
CO4	M	M	S	S	S	L	M
CO5	M	S	M	M	L	S	M

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	2	2	2	3
CO3	3	3	2	2	3
CO4	3	2	2	3	3
CO5	3	2	2	3	3
Weightage	15	12	11	13	15
Weighted Percentage of Course Contribution to PSOs	3	2.4	2.2	2.6	3