SRI KRISHNA ARTS AND SCIENCE COLLEGE

An Autonomous College Affiliated to Bharathiar University
Re-Accredited by NAAC with 'A' Grade
Coimbatore - 641 008, Tamil Nadu, India.

Choice Based Credit System (CBCS)

Scheme of Instruction and Syllabus for

M.Sc. Electronics and Communication Systems

Effective from 2019-20 and onwards

DEPARTMENT OF ELECTRONICS AND COMMUNICATION SYSTEMS

SRI KRISHNA ARTS AND SCIENCE COLLEGE

An Autonomous College affiliated to Bharathiar University
Coimbatore - 641 008, Tamil Nadu, India.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION SYSTEMS

SCHEME OF EXAMINATION – CBCS PATTERN

Programme: M.Sc. Electronics and Communication Systems
(Effective from the Academic Year 2019-20)

Curriculum Structure, Credits & Marks Distribution

Course Type	Number of Courses	Credits per Course	Total Credits	Marks	Semester
Discipline Specific Courses (DSC)		4-6	72	1850	I to IV
Discipline Specific Elective Courses (DSE)	2	5	10	200	II & III
Generic Electives Courses (GEC)	2	4	8	200	II & III
Non CGPA Credit Course (NCCC) Any one MOOC offered in SWAYAM/NPTEL online portal	1	3	3	-	I to IV
Total			**93**	**2250**	

Semester – I									
Course Code	**Course Title**	**T/ P**	**Ins. Hrs/ week**	**MAP Code**	**Examination**				**Credits**
					Dur. Hrs	**CIA**	**ES**	**Total Marks**	
19ECP01	**DSC-I** Telecommunication and Fiber Optics	T	4	H	3	25	75	100	4
19ECP02	**DSC-II** Instrumentation and Control Systems	T	4	D	3	25	75	100	4
19ECP03	**DSC-III** MEMS and Power Electronics	T	4	D	3	25	75	100	4
19ECP04	**DSC-IV** ASIC Design	T	5	D	3	25	75	100	5
19ECP05	**DSC-V** 8051 Microcontroller with C Programming	T	5	D	3	25	75	100	5
19ECP06	**DSC Practical-I** Instrumentation and Power Electronics Lab	P	4	M	4	40	60	100	2
19ECP07	**DSC Practical-II** VHDL and Verilog Programming Lab	P	4	K	4	40	60	100	2
Total			**30**					**700**	**26**

Semester – II									
Course Code	**Course Title**	**T/ P**	**Ins. Hrs/ week**	**MAP Code**	**Examination**				**Credits**
					Dur. Hrs	**CIA**	**ES**	**Total Marks**	
19ECP08	**DSC- VI** Wireless Communications and Networks	T	4	H	3	25	75	100	5
19ECP09	**DSC-VII** Digital Image Processing	T	5	D	3	25	75	100	5
19ECP10	**DSC-VIII** PIC Microcontroller and Embedded Systems	T	5	D	3	25	75	100	5
19ECP11	**DSC Practical-III** Communication Systems Lab	P	4	M	4	40	60	100	2
19ECP12	**DSC Practical-IV** Embedded Systems Lab	P	4	M	4	40	60	100	2
19ECP13A 19ECP13B	**DSE-I** Robotics and Automation / Virtual Instrumentation	T T	4 4	H D	3 3	25 25	75 75	100 100	5 5
19GEP15	**GEC-I** Android Programming	T	4	F	3	20	55	75	3
Total			**30**					**675**	**27**

Semester – III									
Course Code	Course Title	T/ P	Ins. Hrs/ week	MAP Code	Examination				Credits
					Dur. Hrs	CIA	ES	Total	
19ECP14	**DSC-IX** Digital Signal Processing	T	5	H	3	25	75	100	5
19ECP15	**DSC-X** Programmable Logic Controller and SCADA	T	4	D	3	25	75	100	5
19ECP16	**DSC-XI** Raspberry Pi and IoT	T	5	D	3	25	75	100	5
19ECP17	**DSC Practical-V** Digital Signal and Image Processing Lab	P	4	M	4	40	60	100	2
19ECP18	**DSC Practical-VI** PLC and Raspberry Pi Programming Lab	P	4	M	4	40	60	100	2
19ECP19A 19ECP19B	**DSE-II** Artificial Intelligence / Automotive Electronics	T T	4 4	C H	3 3	25 25	75 75	100 100	5 5
19GEP16	**GEC-II** LINUX and Shell Programming	T	4	F	3	20	55	75	3
Total			**30**					**675**	**27**

Semester – IV									
Course Code	Course Title	T/ P	Ins. Hrs/ week	MAP Code	Examination				Credits
					Dur. Hrs	CIA	ES	Total	
19ECP20	**DSC-XII** Project Work & Viva Voce		-	N	-	50	100	150	8
19GEP17	**GEC Practical** LINUX and Android Programming Lab	P	3	K	3	20	30	50	2
	Non CGPA Credit Course (NCCC) Any one MOOC offered in SWAYAM/NPTEL online portal		-	-	-	-	-	Completed	3
Total			**3**					**200**	**10+3**
Total								**2250**	**90+3**

Descriptions and Regulations

1. Project Work & Viva-Voce

During the fourth semester each student should undertake a project work and submit the report. A guide will be allotted to each student by the Department. Student can select any research topic in discussion with the guide. Project report will be evaluated jointly by the internal and external examiners for 75 Marks and Viva-voce examination shall be conducted jointly for 25 Marks.

Dissertation & Viva-voce	100 Marks
CIA	50 Marks

Mark Distribution for CIA

First Review	20 Marks
Second Review	20 Marks
Work Diary	10 Marks

2. Non CGPA Credit Courses (NCCC)

These courses are intended to bring out and promote the self-learning initiative of the students – where their own motivation is what drives them to complete the course and not external compulsions. This fosters the habit of keeping oneself updated always by means of self-study. It gives the students the opportunities to explore new areas of interest and earn additional credits. Students can take any number of courses under this cafeteria system, three credits will be given on completion of each course. The credits will not be taken for CGPA calculation.

1. Compulsory Non CGPA Credit Course

Any one MOOC shall be completed anytime during the programme, offered in SWAYAM/NPTEL online portal under MHRD, Govt. of India. The course must be of minimum 4 weeks duration.

2. Additional Non CGPA Credit Courses

a) MOOC: Apart from completing one compulsory MOOC, students can take any number of online courses offered in SWAYAM/NPTEL online portal and earn additional credits. When a student take more number of online courses, the first course will be taken for compulsory MOOC and for the subsequent MOOCs additional credits will be given in the same semester upon clearing the exam and submitting certificate at least 15 days before the release of semester examination results.

b) Additional Credit Courses (ACC): The College will release list of additional credit courses of self study nature during every semester. Upon clearing the exam three additional credits will be given for each ACC.

3. Generic Elective Courses (GEC)

Generic Elective Courses are the inter-disciplinary courses with an intention to seek exposure beyond discipline of choice. The students are required to study two of them during second and third semester.

The list of GECs offered by ECS Department

Offered to	SEM	Course Code	Course Title	T/P	Ins. Hrs/ week	MAP Code	Examination				Credits
							Dur Hrs	CIA	ES	Total Marks	
M.Sc (SS)	I	19GEP20	Digital Electronics	T	4	H	3	25	75	100	3
	I	19GEP21	Digital Electronics Lab	P	3	L	3	40	60	100	2
	II	19GEP22	Embedded Systems	T	4	F	3	25	75	100	3
	II	19GEP23	Embedded Systems Lab	P	3	M	3	40	60	100	2
	III	19GEP24	PC Hardware	T	5	H	3	25	75	100	3
M.Sc (IT) & M.Sc (CT)	II	19GEP25	Robotics and Arduino Programming	T	4	H	3	15	45	60	3
	II	19GEP26	Robotics and Arduino Programming Lab	P	3	M	3	15	25	40	1

MODULAR ASSESSING PANEL

PERCENTAGE OF COMPONENTS FOR EACH COURSE

COURSE PANEL

S. No.	Modules	Language Concepts	Language Usage	Theory-Concepts	Theory-Applications	Theory-Skill Based	Theory-Programming	Theory-Analytics	Theory-Technology	Problem-Concepts	Problem-Analysis	Practical-Programming	Practical-Experiments	Practical-Applications	Project	Training
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	ICIA-Test	20	20	20	20	20	20	20	20	20	20	20	20	20		
2	IICIA-DIA	10	10	10	10	10	10	10	10	10	10					
3	Model Exam	30	30	30	30	30	30	30	30	30	30	20	20	20		
4	Class Presentation	10	10		10	10		10	10						60	
5	Technical Presentation/ Demonstration			10		10	10	10		10		20	20		20	60
6	Attendance											20	20	20		
7	Group Assignments			10		10				10						
8	Group-Mini project				10			10								
9	Case study					10					10					
10	Group discussion	10	10					10								20
11	Writing skills	10	10	10			10									
12	Simulation exercises						10		10	10	10		20			
13	Poster Presentation/Flow charts/Miniatures/Protocols	10	10	10	10		10		10	10	10	20		20	20	20
14	SSA/self-support assignment (Upcoming technical)				10				10		10			20		
CIA Marks		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Programme	Course code	Title
M.Sc (ECS)	**19ECP01**	**Telecommunication and Fiber Optics**

Preamble: This course introduces the student to the fundamentals of digital telecommunication systems and to develop knowledge on contemporary optical communication technology.

Expected Level of Output : Conceptual and Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory-Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Digital Switching** Evaluation of digital switching system; Digital transmission and its advantages	A	5	2
	Digital signal encoding formats; Asynchronous and Synchronous transmission	A	5	2
	Space division switching; Time division switching; Analog TDS and Digital TDS; Space & time switching	A	5	2
	Time & Space switching; STS &TST switching	A	5	2
II	**Call Processing & Signaling Techniques** Call Processing: Signal Exchange Diagram; State Transition Diagram	A	6	2
	Signaling Techniques: Signaling Classifications; In-channel signaling; Multi-frequency AC signaling	A	7	2
	Voice frequency AC signaling; Out band signaling; PCM signaling	A	7	2
	Common Channel Signaling: CCS Signaling Message Formats; CCS Network; CCS Implementation	A	7	2
III	**Telephone and Transmission Network Organization** Network planning; Types of networks; Numbering plan	A	9 &10	2
	Digital Multiplexing: Time Division Multiplexing	A	10	2
	Wavelength Division Multiplexing; Dense Wavelength Division Multiplexing	A	10	2
	SONET/SDH: SONET Components; SONET network and layers	A	10	2
	SONET frame format; SONET Topologies	A	10	2
IV	**Optical Fiber Communication** Evolution of Fiber Optic System; Principle and Propagation of light in optical fibers	B	1	2
	Numerical aperture and Acceptance angle	B	-	1
	Types of Optical Fibers: single and multimode, step index and graded index fibers; Applications	B	2	2
	Basic Fiber Optic Communication System	B	-	1
	Attenuation, Absorption, Scattering losses, Bending loss, Dispersion	B	3	2

	Fiber Optical Sources: LED structures, Modulation of a LED, Lasers Diodes, PIN and APD diodes	B	4	2
	Fiber-to-Fiber joints, Fiber splicing	B	5	2
V	**Advanced Optical Fiber Communication** Fiber Optics in Different Environment: Wide Area Telecommunication Systems; Local Area Data Communication Systems	C	10	2
	Test Equipment and Techniques: Optical multi-meter; Optical Time Domain Reflectometers; Spectrum analyzers; Eye diagrams	C	7	2
	Hybrid Fiber-Coax Networks	C	10	2
	FTTC/FTTS/FTTN; Passive Optical Networks	C	11	2
	Revision			2
	Total Hours			**48**

Note: 100% Theory
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. P.Gnanasivam, "*Telecommunication Switching and Networks"*, New Age International (P) Ltd, Second Edition, 2010.
B. Gerd Keiser, *"Optical Fiber Communication"*, McGraw Hill Education; Fifth edition, 2017.
C. Kushal Roy, "*Advanced Optical Fiber communication"* SciTech Publications (India) Pvt Ltd, First Edition, 2010.

References:

A. Thiagarajan Viswanathan, "*Telecommunication Switching Systems and Networks"*, Prentice Hall of India Private Limited, 2004.
B. John M Senior, *"Optical Fiber Communications Principles and Practice"*, Pearson Education Limited, Third edition, 2009.
C. http://nptel.ac.in/courses/117101002/
D. http://nptel.ac.in/courses/117105076/

Programme	Course Code	Title
M.Sc (ECS)	19ECP02	Instrumentation and Control Systems

Preamble: This course is designed to provide a knowledge base in the area of instrumentation and control systems to impart the concept of transducers, digital instruments, measurements and data acquisition. It also covers time and frequency domain analysis and PD, PI and PID Controller.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Application)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Performance Characteristics and Transducers** Introduction, Performance characteristics; Static characteristics	A	1	1
	Dynamic characteristics; Dynamic response of Zero order instruments; Dynamic response of First order instruments; Dynamic response of Second order instruments	A	1	2
	Resistive transducers; Inductive transducer; Capacitive Transducer; load cell	A	13	2
	Piezoelectric transducer; Photo electric transducers; Temperature transducers	A	13	2
	LVDT; RVDT	A	13	1
II	**Digital Instruments and Data Acquisition** Digital multi-meter; Digital frequency meter	A	6	1
	Digital measurement of time; Digital measurement of mains frequency	A	6	2
	Digital tachometer; Digital phase meter; Digital capacitance meter	A	6	2
	AC and DC signal conditioning system	A	14	1
	Data Acquisition and Conversion; Single Channel Data Acquisition System; Multi-Channel DAS	A	17	1
	Data Loggers; Digital Transducer	A	17	1
III	**Concepts of Control Systems** Introduction; Open and Closed loop control systems; Examples; Elements of closed loop systems; Linear and Nonlinear systems	B	1	2
	Block diagram; Properties and reduction; Signal flow graphs; Mason's gain formula	B	3	2
	Physical system representation; Electrical systems	B	4	2
	Transfer function of Feedback control system	B	5	1
	Effect of feedback on overall gain, Stability, Sensitivity and Noise	B	5	1
IV	**Time Response and Stability Analysis** Test signals for the time response of control systems	C	7	1

	First order system: Impulse and Step input analysis; Second order system analysis	C	7	3
	Stability Analysis: Characteristics equation; Absolute and Relative stability; Routh Hurwitz stability criterion; Polar plot; Nyquist stability criterion	B	7	3
	Bode plot	B	7	1
V	**Design of Control Systems** Control system compensations; Cascade and Feedback compensation	C	10	2
	Design with the PD, PI and PID Controller	C	10	2
	Design with phase-lead controller; Design with phase-lag controller	C	10	2
	Design with lead-lag controller; State feedback control	C	10	2
	Applications: Temperature controller; Thickness measurement	-	-	1
	Revision			3
	Total Hours			**44**

Note: 80% Theory; 20% Problems
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. H.S.Kalsi, *"Electronic Instrumentation",* Tata McGraw Hill Education Private Limited, Third Edition, 2010.
B. S.N.Verma, *"Automatic Control Systems*", Khanna Publishers, Fifth Edition, Second Reprint, 2010.
C. Benjamin C.Kuo, *"Automatic Control Systems",* Prentice-Hall of India Private Limited, Seventh Edition, 2003.

References:

A. Ernest O. Doebelin, *"Measurement Systems"*, McGraw Hill Education, Sixth Edition, 2017.
B. I.J.Nagrath, M. Gopal "*Control System Engineering*", New Age International (P) Ltd Publishers, Fourth Edition, 2006.
C. A.K.Sawhney, *"A Course in Electrical and Electronic Measurements & Instrumentation"*, Dhanpat Rai Publications, 2001.
D. Katsuhiko Ogata, *"Modern Control Engineering",* Prentice-Hall of India private Limited, Fourth Edition, 2002.
E. http://nptel.ac.in/courses/108105062/

Programme	Course Code	Title
M.Sc (ECS)	19ECP03	MEMS and Power Electronics

Preamble: This course is designed to impart knowledge regarding concepts of Micro Electro Mechanical System and Power Electronics, and emphasis on its applications in several scientific and industrial fields.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Overview and Working Principles of MEMS** MEMS and Microsystems; Typical MEMS and Microsystems products	A	1	2
	Microsystems and Microelectronics; Miniaturization	A	1	2
	Applications of Microsystems; Micro sensors; Micro actuation	A	1,2	2
	Micro grippers; Micro motors; Micro accelerometer	A	2	2
II	**Fabrication and Micro System Design** Ions and Ionization, Doping; Substrate and wafers; Silicon as a substrate; Silicon compounds	A	3,6	2
	Piezo Resistors; Piezo Crystals; Photolithography; Ion implantation; Diffusion; Oxidation	A	7,8	2
	PVD: Etching; Surface Micromachining; LIGA process	A	8	2
	Microsystems Design Considerations; Use of CAD and tools in Microsystems design	A	10	2
III	**Power Electronic Devices and Circuits** Operations of SCR, TRIAC, DIAC, IGBT	C	2	2
	Thyristor Commutation Techniques Natural commutation; Forced commutation	C	5	1
	Self commutation; Impulse commutation; Response pulse commutation; External pulse commutation; complementary commutation	C	5	3
	Controlled Rectifiers Principle of Phase controlled converter; Single-Phase full converter	B	10	1
	Single-phase semi converter; Principle of Three phase half wave converter	B	10	2
IV	**AC Voltage Controller** Principle of On/Off Control; Principle of Phase Control	B	11	1
	Single Phase Bi-Directional Controllers with Resistive Loads; Cyclo-Converters; Single Phase Cyclo-Converters	B	11	2
	DC Choppers Principles of Step-down Operation; Principle of Step-up Operation	B	5	1

	Switch mode regulator; Buck Regulator; Boost Regulator; Buck Boost Regulator; CUK Regulator	B	5	3
V	**Inverters** Principle of Operation; Single Phase Bridge Inverter; Three-Phase Inverter; PWM Voltage Control	B	6	2
	Power Supplies DC Power Supplies; Switched Mode Power Supplies (SMPS); UPS; AC Power Supplies: Switched mode AC power supply; Resonant AC Power supply; Bi-Directional AC Power supply	C	11	4
	AC and DC static switches; Static circuit breaker; AC and DC solid state relay	C	11	2
	Revision			4
	Total Hours			**44**

Note: 100% Theory
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. Tai-Ran-Hsu, "*MEMS & Micro Systems Design and Manufacture*", Tata McGraw Hill Education Private Limited, 2002.
B. Muhammed Rashid, *"Power Electronics, Circuits, devices and Applications*", Prentice Hall Edition, Third Edition, 2004.
C. P.S.Bimbra, *"Power Electronics",* Khanna Publishers, Fourth Edition, 2011.

References:

A. Jaganathan.V, *"Power Electronics Devices and Circuits"*, PHI Learning Pvt. Ltd, Second Edition, 2011.
B. http://nptel.ac.in/courses/117105082

Programme	Course code	Title
M.Sc (ECS)	**19ECP04**	**ASIC Design**

Preamble: This course teaches the architectures of PLDs and FPGA, VHDL and Verilog Hardware Description Languages (HDL), and Simulation process and testing of logic circuits.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Introduction to ASICs** Types of ASICs: Full-Custom ASICs; Standard-Cell Based ASICs	A	1	2
	Gate-Array Based ASICs; Channeled Gate Array; Channel-less Gate Array; Structured Gate Array; Field-Programmable Gate Arrays; Design Flow	A	1	3
	Programmable ASICs: Anti-fuse; Static RAM; EPROM and EEPROM Technology	A	4	2
	Programmable Logic Devices: PLA; PAL; CPLD; Field-Programmable Gate Arrays	D	3	3
II	**VHDL** Introduction; Hardware abstraction	B	1	1
	Data objects; Data types; Operators	B	3	2
	Behavioral Modeling: Entity declaration; Architecture body; process statement; variable and signal assignment statements; Wait, If, Case, Loop statements; Delay Models; Examples	B	4	4
	Dataflow modelling: Concurrent signal assignment statement; Conditional signal assignment statement; Selected signal assignment statement; Unaffected value; Examples	B	5	3
	Structural Modelling: Component declaration; Component Instantiation; Examples	B	6	2
III	**Verilog HDL** Language Elements: Identifiers; Comments; Format; Complier directives; Data types; Operators	C	3, 4	2
	Gate-Level Modeling with examples	C	5	2
	Dataflow Modeling with examples	C	7	2
	Behavioral Modeling: Procedural constructs; Timing controls; Conditional statement; Case statement; Loop statements; Examples	C	8	3
	Structural Modeling with examples	C	9	1
IV	**Synthesis:** Combinational logic synthesis; FSM synthesis	A	12	2
	Simulation: Types of simulation	A	13	1

	Partitioning: System partitioning; FPGA partitioning	A	15	2
	Floor planning and Placement: Floor planning goals and objectives; Floor planning tools; Placement goals and objectives; Measurement of placement goals and objectives; Placement algorithms	A	16	4
	Routing: Global routing and detailed routing	A	17	1
V	**Testing of Logic Circuits** Fault models; Complexity of a test set	D	11	2
	Path sensitizing; Circuits with tree structure; Random test	D	11	3
	Testing of sequential circuits: Design for testability	D	11	2
	Built-in self test	D	11	1
	Revision			5
	Total Hours			**55**

Note: 70% Theory; 30% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. Michael John Sebastian Smith, "*Application specific Integrated Circuits*", Addition-Wesley, Second Reprint, 2000.
B. Bhasker. J, "*A VHDL Primer*", PHI Learning Pvt. Ltd., Third Edition, 2008.
C. Bhasker. J, "*A Verilog HDL Primer*", BS Publications, Fourth Reprint, 2007.
D. Stephen Brown and Zvonko Vranesic, *"Fundamentals of Digital Logic Design with VHDL"*, Tata McGraw-Hill, Second Edition, 2007.

References:

A. Gaganpreet Kaur, *"VHDL: Basics to Programming",* Pearson Education India, First Edition, 2011.
B. Michael D. Ciletti, "*Advanced Digital Design with the Verilog HDL*", Prentice-Hall of India, Fifth Indian Reprint, 2005.
C. http://nptel.ac.in/courses/117106092/
D. http://nptel.ac.in/courses/106103116/

Programme	Course Code	Title
M.Sc (ECS)	19ECP05	8051 Microcontroller with C Programming

Preamble: This course deals about the architecture of 8051 microcontroller and design a microcontroller based small industrial applications. This course will help students in understanding the importance of different peripheral devices and their interfacing to 8051 MCU.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**8051 Architecture and Memory Organization** Microcontrollers and Embedded processors; Microcontrollers for embedded systems	A	1	2
	Overview of 8051 family	A	1	1
	Architecture of 8051	A	1	2
	8051 Memory organization: RAM allocation; SFR and Program memory	A	2	2
	Data types and directives; Flag bits and PSW register	A	2	1
	Program counter; Instruction fetching, decoding and execution concepts	A	2	2
II	**Instruction Set and Addressing Modes** 8051instruction set: Data transfer; Arithmetic; Logical; Boolean; Branching	A	6	4
	Introduction to ALP: Unsigned addition and subtraction	A	6	1
	Unsigned Multiplication and division	A	6	2
	Logical operations: Verification of Demorgan's theorem	A	4&5	2
	Addressing modes	A	4&5	2
III	**ALP & Embedded C Programming** Data types; Simple data transfer programs in ALP and C	A	7	2
	Arithmetic operation: Multi byte addition in ALP and C	A	7	2
	Logical operation: Verification of Boolean functions in ALP and C	A	7	2
	I/O port programming: Single bit operations in ALP and C	A	6	2
	Time delay programming and delay calculation in ALP and C; Square wave generation with specific frequency	A	7	2
IV	**8051Peripherals and Interrupts** **Timers:** Basic registers of timer; Programming 8051 timer and counter in ALP and C	A	9	2
	UART: Serial communication registers; 8051 connection to RS232; 8051 serial communication programming in ALP and C	A	10	4

	8051 Interrupts: Interrupts registers	A	10	1
	Programming timer interrupts; Programming external hardware interrupts; Programming with serial communication interrupts in ALP and C	A	11	3
	Real World Applications I/O Interfacing: Key, LED and LCD Interfacing	A	12	2
	ADC Interfacing; Sensor interfacing; DAC Interfacing	A	13	3
V	Relays and Opto-isolator interfacing	A	16&17	1
	Interfacing stepper motor and DC motor	A	16&17	2
	RTC interfacing	A	17&12	1
	Revision			5
	Total Hours			**55**

Note: 70% Theory; 30% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text Book:

A. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, *"The 8051 Microcontroller and Embedded Systems using Assembly and C"*, Pearson Second Edition, 2008.

References:

A. Alka Kalra, Sanjeev Kumar Kalra, *"Architecture and Programming of 8051 Microcontroller"*, Laxmi Publications, 2010.
B. Manish K Patel, *"The 8051 Microcontroller Based Embedded Systems"*, McGraw Hill Education India Private Limited, 2014.
C. http://nptel.ac.in/courses/117104072/
D. http://nptel.ac.in/courses/106108100/

Programme	Course Code	Title
M. Sc (ECS)	19ECP06	Instrumentation and Power Electronics Lab

Preamble: This course is designed to introduce different experiments to test basic understanding of instrumentation and power electronics circuits.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical-Application)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiment	
1	Voltage to Current and Current to Voltage Converters	
2	Load Measurement using Strain Gauge	
3	Displacement and Angular Displacement Measurement	
4	Construction of Digital Voltmeter	
5	Frequency Response of First and Second Order Systems	
6	SCR and TRIAC Characteristics	
7	UJT Characteristics and Saw-tooth Wave Generator	
8	Firing Angle Control using Thyristors	
9	Commutation Techniques	
10	Single Phase Inverter and Converter	
11	Switching Regulators	
12	PID Controller	
	Repeat/Revision	**8**
	Total Hours	**48**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in Communication Lab
Essential Equipments: Power supply, Function Generator, CRO, Multi-meter, and Pulse Generator.

Programme	Course Code	Title
M.Sc (ECS)	**19ECP07**	**VHDL and Verilog Programming Lab**

Preamble: This course aims to provide students with the practical experience by designing, modeling, implementing and verifying several digital circuits using VHDL and Verilog HDL.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : K (Practical-Programming)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiment	
1	Half Adder and Full Adder	
2	Half Subtractor and Full Subtractor	
3	Encoder [8:3] and Decoder [3:8]	
4	Multiplexer [8:1] and De-multiplexer [1:8]	
5	D, T and JK Flip-Flops	
6	4-bit UP/DOWN Counters	
7	4-bit Shift Register and Ring Counter	
8	Implementation of ALU	
9	Water Level Controller	
10	DC Motor Interface	
11	Seven-Segment Display Interface	
12	Elevator Controller	
	Repeat/Revision	**8**
	Total Hours	**48**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in DSP Lab

Essential Software : Xilinx, Quartus-II, Active VHDL

Essential Equipments : Personal Computer, FPGA/Altera Trainer Kit, CRO and Multi-meter.

Programme	Course Code	Title
M.Sc (ECS)	19ECP08	Wireless Communications and Networks

Preamble: This course provides the concept of network protocols, wireless technology, satellite and cellular networks and IEEE 802.11 wireless LAN standards.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory-Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Protocol and TCP/IP Suite** Need for a protocol architecture; TCP/IP Protocol architecture	A	4	2
	Operation of TCP and IP; TCP/IP Applications	A	4	2
	The OSI Model; Internetworking; IP; TCP; UDP	A	4	4
II	**Cellular Wireless Networks** Principles of Cellular Network; Cellular Network organization; Frequency reuse	A	5	2
	Increasing capacity; Operation of Cellular Systems; Mobile radio propagation Effects	A	5	3
	Handoff; Power Control; Traffic Engineering	A	5	2
III	**Mobile Phone Generations** First generation Analog; Second generation TDMA; GSM; GSM network Architecture	A	5	3
	Radio link aspects; GSM Signaling Protocol architecture; Second generation CDMA	A	5	3
	Rake receiver; IS-95; Forward link; Reverse Link; Third generation System; CDMA design considerations	A	5	3
IV	**Satellite Communication** Frequency Allocations for Satellite Services; Kepler's I,II,II laws; Orbital parameters	-	-	2
	Orbital perturbations, station keeping	-	-	1
	Geo stationary and non Geo-stationary orbits	-	-	2
	Earth station technology; Transponders	-	-	2
	Down-link design, up-link design	-	-	1
	FDM; FDMA; Capacity allocation; Time Division	A	10	2
	Introduction to VSAT systems	A	10	1
V	**IEEE 802.11 Wireless LAN Standard and Bluetooth** IEEE 802 Architecture; MAC frame format; Logical Link Control; IEEE 802.11: Architecture; Services; Reliable data delivery	A	14	3
	Medium access control; Distributed coordination function; Point coordination function; MAC frame	A	14	2

	Bluetooth: Bluetooth Standards Documents; Protocol architecture; Usage models; Pico-nets and Scatter-nets; Radio specification	A	15	3
	Revision			5
	Total Hours			**48**

Note: 100% Theory
CIA: 25 Marks; **End Semester:** 75 Marks

Text Book:

A. William Stallings, *"Wireless Communications and Networks",* Pearson Education Asia, Second Edition, 2012.

References:

A. Behrouz A. Forouzan, *"Data Communications And Networking",* McGraw Hill Education; Fourth edition, 2017.
B. William Stallings, *"Data and Computer Communication",* Pearson Education, Sixth Edition, 2000.
C. Gary S. Rogers and John S. Edwards, *"Introduction to Wireless Technology",* Pearson Education, First Edition, 2007.
D. http://nptel.ac.in/courses/117102062/

Programme	Course Code	Title
M.Sc (ECS)	19ECP09	Digital Image Processing

Preamble: This course is an introduction to the fundamental concepts and techniques in basic digital image processing and their applications. The course of study will emphasize on the Image Transforms, Image Enhancement, Image Compression, Image segmentation and Representation.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Digital Image Fundamentals** Introduction; Examples of fields that use digital image processing	A	1	2
	Fundamental steps in digital image processing; Components of an image processing system	A	1	2
	Structure of the human eye; Image formation; Brightness adaptation and discrimination; Simultaneous contrast	A	2	2
	Image sensing and acquisition	A	2	1
	Image Sampling and Quantization; Representing Digital images; Spatial and Intensity resolution	A	2	2
	Neighbors of pixel; Adjacency; Connectivity; Regions; Boundaries; Distance measures	A	2	2
II	**Image Transforms** Introduction; Fourier transform; 2D Discrete Fourier Transform	B	4	2
	Properties of two-dimensional Fourier Transform: Separability, Shift, Periodicity, Convolution, Correlation	B	4	2
	Scaling, Conjugate symmetry, Orthogonality, Rotation	B	4	1
	Walsh transform; Hadamard transform	B	4	2
	Discrete Cosine Transform; Comparison of different image transforms	B	4	2
III	**Image Enhancement** Spatial domain methods; Frequency domain methods	A	3	2
	Enhancement by point processing; Intensity transformations; Contrast stretching; Thresholding	A	3	2
	Image Negatives; Intensity level slicing; Bit plane slicing	A	3	2
	Histogram processing; Histogram equalization	A	3	2
	Spatial Filtering; Smoothing filters; Low pass filtering; Median filtering; Sharpening Filters; High pass filtering; Derivative filters	A	3	2

IV	**Image Compression** Fundamentals; Redundancies; Objective and subjective fidelity criteria	A	8	2
	Image compression models; General image compression system	A	8	2
	Huffman Coding; Run length coding	A	8	2
	Bit plane coding; Transform coding	A	8	2
	Predictive coding; Lossless predictive coding; Lossy predictive coding; Delta modulation coding; DPCM coding	A	8	2
V	**Image Segmentation and Representation** Edge based segmentation; Region based segmentation	A	10	2
	Point, Line, and Edge detection: Detection of isolated points; Line detection; Edge detection; Gradient operators	A	10	3
	Edge linking and Boundary detection	A	10	1
	Boundary representation; Boundary description, Fourier Descriptor, Regional Descriptors	A	11	3
	Recognition based on matching	A	12	1
	Revision			5
	Total Hours			**55**

Note: 80% Theory; 20% Problem
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. Rafael C. Gonzalez and Richard E. Woods, *"Digital Image Processing",* Pearson Prentice Hall, Twelfth Impression, 2013.
B. S. Jayaraman, S. Esakkirajan and T. Veerakumar, *"Digital Image Processing",* Tata McGraw Hill, Third Reprint, 2010.

References:

A. S. Annadurai, *"Fundamentals of Digital Image Processing",* Pearson Education India, 2007.
B. Anil K. Jain, *"Fundamentals of Digital Image Processing",* Prentice-Hall of India Private Limited, 2006.
C. http://www.imageprocessingplace.com
D. http://nptel.ac.in/courses/117105079/
E. http://nptel.ac.in/courses/117104069/

Programme	Course Code	Title
M.Sc (ECS)	19ECP10	PIC Microcontroller and Embedded Systems

Preamble: This course is designed to provide the students with the basic understanding of PIC18 microcontroller based systems. The students get acquainted with hardware and software design process of embedded systems.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**PIC18F Microcontroller** Overview of the PIC18 MCU	A	1	1
	PIC18F memory organization; PIC18F CPU registers; WREG, FILE and STATUS Registers	A	1	2
	PIC18F pipelining; Instruction Format	A	1	2
	Addressing modes	A	1	2
	PIC18F instructions: Arithmetic, Logic, Branch, Call instructions	B	3&5	3
II	**PIC18F Assembly Language Programming** Assembly language program structure	A	2	1
	Perform arithmetic operations: Addition, Subtraction, Multiplication	A	2	2
	Create time delay using program loop	A	2	2
	PIC18 I/O Ports PIC18F458 pin diagram; PORT, TRIS and LAT Registers; Block diagram of I/O port pin; Port A, Port B, port C, Port D, Port E	B	9	2
	Programs: Blinking LED; LCD interfacing	-	-	2
III	**PIC18 Interrupts** Basic of Interrupts; PIC18 Interrupt priority; Registers related to interrupts	A	6	2
	PIC18 interrupt operation: INT pin interrupts, Port B pin change interrupt, Peripheral interrupt; PIC18 Interrupt programming	A	6	3
	PIC18 Timers Overview of PIC18 Timer Functions	A	8	1
	Block diagram and registers of Timer0, Timer1, Timer2 and Timer3	A	8	3
	PIC18 Timer Programming	A	8	1
IV	**PIC18 CCP Modules** CCPxCON register; CCP Module Configuration	A	8	1
	Capture mode operation block diagram; Applications	A	8	2
	Compare mode operation block diagram; Applications	A	8	2

	PWM mode operation block diagram; Applications	A	8	1
	PIC18 Serial Communication Interface USART related registers	A	9	1
	USART Asynchronous mode: USART transmit and receive block diagrams	A	9	2
	USART Synchronous master mode; USART Synchronous slave mode	A	9	1
V	**I^2C Interface** I^2C Protocol; PIC18 MSSP module; MSSP Module in I^2C Mode block diagram; Registers for I^2C operation	A	11	2
	I^2C master mode; Master mode transmission; Master mode reception	A	11	2
	I^2C slave mode; Reception in slave mode; Transmission in slave mode	A	11	2
	PIC18 A/D Converter Register associated with A/D converter: ADCON0, ADCON1, ADCON2, ADRESH and ADRESL	A	12	2
	Selecting the A/D conversion clock; A/D Acquisition requirements	A	12	2
	A/D conversion process; Procedure for performing A/D conversion	A	12	1
	Revision			5
	Total Hours			**55**

Note: 80% Theory; 20% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books/Manuals:

A. Han-Way Huang, *"PIC-Microcontroller- An introduction to software and hardware interfacing",* Cengage Learning India Pvt. Ltd., Reprint 2008.
B. Microchip - *PIC18FXX8* Data Sheet.

References:

A. Muhammad Ali Mazidi, Rolind D. Mckinlay and Danny Causey, *"PIC microcontroller and Embedded systems using assembly and C for PIC18",* Pearson Publications, Seventh Impression, 2011.
B. Fernando E. Valdes-Perez, Ramon Pallas-Areny, *"Microcontrollers Fundamentals and Applications with PIC"*, CRC Press (Taylor & Francis Group), 2009.
C. Richard Barnett, Larry O'Cull, Sarah Cox, *"Embedded C Programming and the Microchip PIC",* Thomson Delmar Learning, 2004.

Programme	Course Code	Title
M. Sc (ECS)	19ECP11	Communication Systems Lab

Preamble: This course introduces students to the practical concepts of various analog and digital modulations and their spectral characteristics.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical-Application)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiment	
1	Pulse Amplitude Modulation and Pulse Width Modulation	
2	Pulse Code Modulation	
3	Amplitude Shift Keying and Frequency Shift Keying	
4	Phase Shift Keying	
5	QPSK And DPSK	
6	Study of Delta and Adaptive Delta Modulation	
7	IR Transmitter and Receiver	
8	Study of RF Transmitter and Receiver Module	
9	Study of Fiber Optic Transmitter and Receiver	
10	Radiation Pattern of Dipole and Yagi-Uda Antennas	
11	Radiation Pattern of Loop and Array Antennas	
12	TDM and FDM	
	Repeat/Revision	**8**
	Total Hours	**48**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in Communication Lab

Essential Equipments: Power supply, Function Generator, CRO, Multi-meter, Pulse Generator, Antenna Kit and Fiber optic module and Communication Trainer Kits.

Programme	Course Code	Title
M.Sc (ECS)	**19ECP12**	**Embedded Systems Lab**

Preamble: This course allows students to develop and execute programs using software tools and microcontrollers with peripheral interfaces. The experiments listed below to expose the students into revising the concepts acquired from theory course.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical-Application)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiment	
	Using PIC18F Microcontroller Series	
1	Arithmetic and Logical Operations using ALP	
2	Square Wave Generation	
3	LCD Interface	
4	Stepper Motor Interface	
5	Key and Relay Interface using Interrupt	
6	Seconds Counter using On-chip Timer	
7	Speed Control of DC Motor using PWM	
8	Serial Communication using RS232	
9	RF/ZigBee Communication	
10	Temperature Measurement	
11	RTC Interfacing using I^2C Protocol	
12	USB Communication	
	Repeat/Revision	**8**
	Total Hours	**48**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in DSP Lab

Essential Equipments : Power Supply, DSO, Personal Computer, PICKIT-2/3 Programmer

Essential Software : MPLAB IDE, XC8 Compiler and PICKIT-2/3 Programmer Software.

Programme	Course Code	Title
M.Sc (ECS)	19ECP13A	Robotics and Automation

Preamble: The course focuses on topics in robotics that relate to fundamentals, actuators, grippers and sensors of robot systems. The course will also explain how to use Arduino to operate lights, motors and sensors for making a robot.

Expected level of output : Conceptual and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory-Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Introduction to Robotics** History; Laws of Robotics; Robot definition	A	1	2
	Robot usage rules; Applications	A	1	1
	Robot subsystems: Motion subsystem; Recognition subsystem; Control subsystem	A	1	3
	Classification of Robots: Cartesian Robot; Cylindrical Robot; Spherical Robot; Articulated Robot	A	2	2
II	**Actuators** Classification of Actuators; Electric Actuators: Stepper motor	A	3	2
	DC Motors; Servo motor; Selection of motors	A	3	2
	Solenoids; Relays; Solid state switches	-	-	1
	Hydraulic Actuators; Pneumatic Actuators	A	3	1
	Grippers Mechanical Grippers; Magnetic Grippers	A	3	2
	Vacuum Grippers; Adhesive Grippers; Selection of grippers	A	3	1
III	**Sensors and Vision Systems** Sensor Classification; Internal Sensor; Position Sensors: Encoder, Potentiometer; LVDT	A	4	2
	Velocity Sensors: Tachometer, Hall-effect sensor	A	4	1
	Accelerometer and Gyroscope sensors	-	-	1
	Force Sensors: Strain-gauge sensor; Piezoelectric sensor	A	4	1
	External sensors; Contact type; Noncontact type: Proximity sensor, Semiconductor displacement sensor	A	4	2
	Vision; Elements in a vision sensor; Steps in a vision system	A	4	1
VI	**Industrial Automation** Automation in production systems; Automation principles and strategies	B	1	1
	Manufacturing industries and products; Manufacturing operations	B	2	1
	Production concepts and mathematical models; cost of manufacturing operations	B	2	2
	Basic elements of an automated systems; Advanced automation functions; Levels of automation	B	3	2

	Fundamentals of automated assembly systems; Design for automated assembly	B	19	2
V	**Robot Programming using Arduino** The Arduino platform; Functional block diagram of Arduino; Arduino family of boards	-	-	1
	Blinking of LED; Key interfacing	C	-	1
	DC motor direction control; DC motor speed control using PWM; Servo motor control	C	-	1
	Interfacing LCD; Interfacing IR sensor; Interfacing Ultrasonic sensor; Tone generation	C	-	2
	Line follower Robot; Obstacle avoider Robot; Self balancing Robot	C	-	3
	PC control Robot; Wireless Robot	C	-	1
	Revision			2
	Total Hours			**44**

Note: 80% Theory; 20% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text books:

A. Subir Kumar Saha, *"Introduction to Robotics"*, McGraw-Hill Education, Second Edition, 2014.
B. Mikell P Groover, *"Automation Production Systems and Computer- Integrated Manufacturing",* Pearson Education, New Delhi, 2001.
C. John-David Warren, Josh Adams, HaraldMolle, *"Arduino Robotics"*, Apress, 2011.

References:

A. Mikell Groover, Mitchell Weiss, Roger Nagel, Nicholas Odrey, Ashish Dutta, *"Industrial Robotics: Technology - Programming and Applications",* Tata McGraw-Hill Education, Second Edition (Special Indian Edition), 2012.
B. R.Mittle, I.Nagrath, *"Robotics and Control"*, Tata McGraw-Hill Education, 2003.
C. S.R. Deb, *"Robotics Technology and Flexible Automation"*, Tata McGraw Hill, Second Edition, 2017.
D. Michael McRoberts, *"Beginning Arduino"*, Second Edition, Apress, 2013.
E. http://nptel.ac.in/courses/112103174/39

Programme	Course Code	Title
M. Sc (ECS)	19ECP13B	Virtual Instrumentation

Preamble: This course will introduce students to the use of the LabVIEW programming language for the collection, manipulation and processing of data from the instruments.

Expected Level of Output : Conceptual and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory - Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Introduction to VI** Virtual Instrumentation Model; Graphical System Design Model; Virtual Instrument and Traditional Instrument	A	1	1
	Hardware and Software in Virtual Instrumentation; Virtual Instrumentation for Test, Control and Design	A	1	1
	Virtual Instrumentation in the Engineering Process; Graphical System Design using LabVIEW	A	1	1
	Advantages of LabVIEW; Software Environment	A	2	1
	Creating and Saving a VI; Front Panel Toolbar; Block Diagram Toolbar	A	2	1
	Palettes; Front Panel Controls and Indicators	A	2	2
	Block Diagram; Data Types; Data Flow Program	A	2	2
II	**VI Programming** For loop; While loop	A	4	1
	Shift register; Feedback nodes	A	4	1
	Control Timing	A	4	1
	Local and Global Variables	A	4	1
	Arrays in LabVIEW; Creating One and Two-Dimensional Arrays	A	5	2
	Clusters	A	6	2
III	**Plotting Data** Types of Waveforms	A	7	1
	Waveform Graphs and Charts; XY Graphs; Customizing Graphs and Charts	A	7	2
	Structures Case Structures; Sequence Structures	A	8	1
	Customizing Structures; Timed Structures	A	8	1
	Strings and File I/O Creating String Controls and Indicators	A	9	1
	Editing, Formatting and Parsing Strings; Configuring String Controls and Indicators	A	9	2
	Basics of File Input/Output; Choosing A File I/O Format	A	9	1

	File I/O VIs; Creating a Relative Path	A	9	1
IV	**Instrument Interfaces** 4–20 mA Current Loop; 60 mA Current Loop	B	5	1
	RS232, RS422 and RS485	B	5	1
	GPIB; VISA	B	5	1
	Hardware Aspects Data Acquisition in LabVIEW; Hardware Installation and Configuration	B	7	2
	Components of DAQ; DAQ Signal Accessory	B	7	1
	DAQ Assistant	B	7	1
	DAQ Hardware; DAQ Software	B	7	1
V	**VI Applications** Fiber-Optic Component Inspection	B	10	1
	Data Acquisition and User Interface of Beam Instrumentation System	B	10	1
	Distributed Multiplatform Control System with LabVIEW	B	10	1
	Developing Remote Front Panel LabVIEW Applications	B	11	1
	Client–Server Applications in LabVIEW	B	11	1
	LabVIEW Interface for School-Network DAQ Card	B	11	1
	PC and LabVIEW-Based Robot Control System	B	11	1
	Revision			2
	Total Hours			**44**

Note: 100% Theory
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. Jovitha Jerome, *"Virtual Instrumentation using LabVIEW"*, PHI Learning Private Limited, 2010.
B. S. Sumathi, P. Surekha, *"LabVIEW based Advanced Instrumentation Systems"*, Springer, 2007.

References:

A. Lisa K Wells, "*LabVIEW for Everyone"*, Prentice Hall of India, 1996.
B. Robert H.Bishop, "*Learning with LabVIEW"*, Prentice Hall, 2003.
C. Garry M Johnson, "*LabVIEW Graphical Programming"*, Tata McGraw Hill, Second Edition, 1996.
D. http://nptel.ac.in/courses/108105062/10

Programme	Course code	Title
M.Sc (ECS)	**19ECP14**	**Digital Signal Processing**

Preamble: This course covers theory and methods for digital signal processing including signals and systems, mathematical methods suitable for signal processing, digital filters and Digital Signal Processor.

Expected Level of Output : Analytical and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory-Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Introduction to Signals and Systems** Signals; Classifications of Signals	A	1	3
	Types of basic signals: Impulse function, Step function, Ramp function, Exponential signal, Sinusoidal signal	A	1	2
	Basic Operations on Signals: Based on dependent variables, Based on independent variables	A	1	1
	Systems; Properties of Systems	A	1	3
	Interconnection of Systems	A	2	1
II	**Fast Fourier Transform(FFT)** Introduction; Direct evaluation of the DFT	A	5	1
	Decimation-in-Time algorithm; Radix-2 DIT-FFT algorithm	A	5	4
	Decimation-in-Frequency algorithm; Radix-2 DIF-FFT algorithm; Differences and similarities between DIT and DIF algorithm	A	5	3
	IDFT using FFT algorithm	A	5	2
III	**Structure for Discrete-Time systems** Block diagram and Signal flow graph representation of linear co-efficient difference equation	B	6	2
	Basic structures for IIR systems: Direct-form; Cascade form; Parallel form	B	6	3
	Basic network structures for FIR systems: Direct-form; Cascade form; Structures for linear-phase FIR systems	B	6	4
	Lattice structure	B	6	1
IV	**Filter Design Techniques** Introduction; Design of Discrete-Time IIR filters from continuous time filters	B	7	1
	IIR Filter design by Impulse invariance and Bilinear transformation	B	7	4
	Design of FIR filter by Rectangular window and Triangular window	B	7	4
	Comparisons of IIR and FIR filter	B	7	1

V	**Digital Signal Processor** TMS320 Family Overview; TMS320C5x Key Features	C	1	1
	Architectural Overview	C	2	2
	Central Arithmetic Logic Unit (CALU); Parallel Logic Unit (PLU); Auxiliary Register Arithmetic Unit (ARAU)	C	3	2
	Program Control: Program Counter (PC); Hardware Stack; Program-Memory Address Generation; Status and Control Registers; Interrupts; Power-Down Mode	C	4	2
	Addressing Modes	C	5	2
	Pipeline Structure; Memory Space Overview	C	7 & 8	1
	Revision			5
	Total Hours			**55**

Note: 70% Theory; 30% Problems
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books/Manuals:

A. S. Poornachandra, B. Sasikala, "*Digital Signal Processing*", Tata McGraw Hill Education Private Limited, Third Edition, 2011.
B. Alan V. Oppenheim, Ronald W. Schafer with John R.Buck, "*Discrete-Time Signal Processing*", Prentice-Hall of India, Second Edition, 2006.
C. *TMS320C5x User's Guide*-Literature Number: SPRU056D-June 1998 from Texas Instruments.

References:

A. John G.Proakis, Dimitris G.Manolakis, "*Digital signal processing principles, algorithms, and applications*", Pearson Education, Third Edition, 2003.
B. P.Remesh Babu, "*Digital Signal Processing*", Scitech Publication, Fourth Edition, 2007.
C. B.Venkataramani, M.Bhaskar, "*Digital signal processing architecture, programming and applications*", Tata McGraw-Hill, Fifth Reprint, 2005.
D. http://nptel.ac.in/courses/117102060/
E. http://nptel.ac.in/courses/117104070/

Programme	Course code	Title
M.Sc (ECS)	19ECP15	Programmable Logic Controller and SCADA

Preamble: This course is designed to provide the knowledge in PLC architecture, programming and SCADA fundamentals.

Expected Level of Output : Analytical and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**PLC Introduction** Parts of PLC; Principles of operation; Modifying the operation; PLC size and application	A	1	3
	PLC Hardware Components: The I/O section; Discrete I/O section; Analog I/O section	A	2	3
	Special I/O modules The CPU; Programming devices	A	2	2
II	**Basics of PLC Programming** Processor memory organization; PLC Programming Languages; Relay type instructions; Instruction addressing; Programming Examine IF closed and Examine IF open instructions	A	5	3
	Electromagnetic control relay; Motor starters; Manually operated switches; Mechanically operated switches	A	6	2
	Proximity sensor: Inductive and capacitive Proximity sensor; Output control devices; Converting relay schematics into PLC ladder programs	A	6	3
III	**PLC Instructions** Timer Instructions: ON-Delay timer instructions; OFF-Delay timer instructions	A	7	2
	Counter Instructions: UP Counter; Down Counter	A	8	2
	Allen-Bradley SLC-500 PLC Instructions: Program control instructions	A	9	2
	Data manipulation instructions; Math instructions	A	9	2
IV	**Applications of PLC** Simple sequence control concepts; Priority determination design; Automatic packing mechanism	B	-	2
	Automatic control of warehouse door; Automatic lubricating oil supplier	B	-	2
	Conveyor belt motor control; Bottle label detection	B	-	2
	Car park control; Ball sorter mechanism	B	-	1
	Temperature control	B	-	1
V	**SCADA** Convergence of Evolving Technologies; Basics of SCADA Signal Processing; Defining the Scope of SCADA	C	1	2

	Software; Use of Generalized Terminology			
	Typical SCADA System Architecture; Sample Application: WTP SCADA System	C	2	2
	Life Cycle of a SCADA Project	C	3	1
	System Graphic Displays; Process Graphic Displays	C	8	2
	Historical Reports and Trend Displays; Special Operating Procedures	C	8	1
	Revision			4
	Total Hours			**44**

Note: 80% Theory; 20% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books/Manuals:

A. Frank D. Petruzella, *"Programmable Logic Controllers",* Tata McGraw Hill, Third Edition, 2010.
B. http://www.pacontrol.com/download/OMRON-PLC-Programming.pdf
C. Stuart G. McCrad, *"Designing SCADA Application Software: A Practical Approach"*, Elsevier, First Edition, 2013.

References:

A. W. Bolton, *"Programmable Logic Controllers",* Elsevier, Fifth Edition Reprint, 2011.
B. Siemens "*PLC Handbook*".
C. Allen-Bradley "*PLC Handbook*".

Programme	Course Code	Title
M.Sc (ECS)	**19ECP16**	**Raspberry Pi and IoT**

Preamble: This course introduces students to the amazing world of IoT and its fascinating applications using a Raspberry Pi computer.

Expected Level of Output : Analytical and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : D (Theory-Applications)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**ARM Processors Overview** History and Features of ARM processors	A	-	1
	Organization of the ARM components; Memory for ARM systems	A	-	2
	ARM pipelines; Modes of operation	A	-	2
	ARM exceptions; Development of the ARM processor families	A	-	2
	Instructions supported by the ARM processors; ARM development tools	A	-	2
II	**ARM Cortex** ARM Cortex processors categories	B	-	1
	ARMv8-A Architecture; ARMv8-A Processor	B	-	2
	Exception levels; Execution states, ARMv7 processor modes	B	-	2
	ARMv7 privilege levels, Cache terminology, Virtual and physical memory	B	-	2
	big.LITTLE Technology, Structure of a big.LITTLE system, Software execution models in big.LITTLE	B	-	2
	Systems on a single chip; Broadcom SoC devices	-	-	1
III	**Raspberry Pi** Introduction to Raspberry Pi; Different Models of Raspberry Pi; Raspberry Pi Architecture	C	-	2
	Peripherals of Raspberry Pi; Applications of Raspberry Pi	C	-	2
	Different Operating Systems for Raspberry Pi; Getting Started With NOOBS; Installation and Setting up Raspberry Pi	C	-	2
	Linux system administration; Installing and Uninstalling Software; Network configuration	C	-	2
	GPIO Port; UART Serial Bus; I²C Bus; SPI Bus	C	-	2
IV	**Python** Understanding Python; Interpreted Languages	D	-	1
	Variables, Keywords, Operators and Operands	D	-	2
	Data Types in Python; Flow Control; Condition Statement	D	-	3
	Loops; Importing Libraries; Functions	D	-	3
	Classes; Accessing SMTP Inbox using Python;	D	-	2

	Manipulating GPIO Pins using Python			
V	**Internet of Things (IoT)** Understanding IoT; History and evaluation; Applications	E	-	1
	Basics of Internet & Internet protocols; Node.js, HTTP, MQTT, MQTT brokers	E	-	2
	Introduction to Cloud Storage models and communication APIs	E	-	2
	Web server for IoT; Cloud for IoT; Python web application framework	E	-	2
	Controlling LED and Motor using IoT; IoT Weather station; Security surveillance using IoT	E	-	3
	Revision			5
	Total Hours			**55**

Note: 80% Theory; 20% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books/Manuals:

A. James A. Langbridge, *"Professional Embedded ARM Development",* Wrox, First Edition, 2014.
B. ARM® Cortex®-A Series, Programmer's Guide for ARMv8-A, Version 1.0
C. Eben Upton and Gareth Halfacree, *"Raspberry Pi User Guide",* Wiley, Fourth Edition, 2016.
D. Raspberry Pi Cookbook
E. Maneesh Rao, *"Internet of Things with Raspberry Pi 3",* Packt Publishing, First Edition, 2018.

References:

A. Eben Upton, Jeffrey Duntemann and Ralph Roberts, *"Learning Computer Architecture with Raspberry Pi",* Wiley, First Edition, 2016.
B. Steve Furber, *"ARM System-on-Chip Architecture",* Second Edition, Addison-Wesley Professional, 2000.
C. Wolfram Donat, *"Learn Raspberry Pi Programming with Python",* Apress, First Edition, 2014.
D. Tim Cox, *"Raspberry Pi for Python Programmers Cookbook".*
E. Arshdeep Bahga and Vijay Madisetti, *"Internet of Things - A Hands-on Approach",* Universities Press, 2015.

Programme	Course Code	Title
M.Sc (ECS)	19ECP17	Digital Signal and Image Processing Lab

Preamble: This course provides an exposure to the specific application areas like digital signal processing and digital image processing.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical – Application)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiment	
	Digital Signal Processing using TMS320C67XX/MATLAB	
1	Arithmetic Operations using ALP	
2	Convolution of Two Discrete Signals	
3	Correlation of Two Discrete Signals	
4	Generation of Impulse, Step, Exponential, Ramp, Sine and Cosine Functions	
5	FIR Filter Design	
6	IIR Filter Design	
	Digital Image Processing using MATLAB	
7	Image Sampling – Zooming & Shrinking Operations	
8	Basic Gray Level Transformations: Image Negative, Power Law and Log Transforms	
9	Image Contrast Enhancement by Histogram Equalization Technique	
10	Spatial Image Filtering: Low Pass and High Pass Filtering	
11	Edge Linking and Boundary Detection	
12	Walsh Transform for 2D Images	
	Repeat/Revision	**8**
	Total Hours	**48**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in DSP Lab

Essential Equipments : DSP Trainer Kit, Power Supply, Function Generator, CRO and Multi-meter

Essential Software : CCS, VI Debugger, Filter Design Package and MATLAB

Programme	Course Code	Title
M.Sc (ECS)	**19ECP18**	**PLC and Raspberry Pi Programming Lab**

Preamble: This course provides practical experience in Programmable Logic Controller and Raspberry Pi single board computer.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical – Application)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiment	
	PLC Programming	
1	Logic Gates using Ladder Logic	
2	Motor Control System	
3	Priority Determination	
4	Water Level Controller	
5	Traffic Light Controller	
6	Object Counter	
	Raspberry Pi Programming using Python	
7	LED Control	
8	Motion Sensor Alarm using PIR Sensor	
9	Wireless Notice Board using GSM	
10	IoT based Home Automation	
11	IoT based Weather Monitoring System using MQTT	
12	IoT based Smart Camera Surveillance System	
	Repeat/Revision	**8**
	Total Hours	**48**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in DSP Lab

Essential Equipments : PLC Trainer kit, Raspberry Pi board and accessories, and Multi-meter

Essential Software : RSlogix, ABB Automation Builder, Raspbian, and Python

Programme	Course Code	Title
M.Sc (ECS)	19ECP19A	Artificial Intelligence

Preamble: The aim of the course is to introduce the field of Artificial Intelligence (AI), as well as the basic concepts and techniques that are used within the field.

Expected level of output : Conceptual Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : C (Theory-Concepts)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Introduction** Artificial Intelligence (AI); Components of AI; History of AI; Development of AI	A	1	2
	Knowledge and Knowledge-based systems; AI in the future; Applications of AI	A	1	2
	Logic and Computation Classical concepts; Computational logic; First-order logic; Symbol tableau	A	1	2
	Resolution; Unification; Predicate Calculus in problem-solving	A	1	2
II	**Heuristic Search** Search-based problems; Informed search; Evaluating functions and ordered research	A	3	2
	Water jug problem using breadth search	A	3	2
	Search in game playing AND/OR graph; Minimax problem	A	4	2
	Alpha-beta search; Puzzle solving algorithm	A	4	2
III	**Knowledge Representation** Structure of an RBS; Merits and demerits; Types of rules; Semantic nets	A	6	2
	Frames; Conceptual graphs; Conceptual dependency; Script	A	6	2
	Automated Reasoning Default reasoning; Model-based reasoning; Case-based reasoning	A	7	3
	Multimodal reasoning; Truth maintenance system	A	7	2
IV	**Machine Learning** A general view; Knowledge acquisition process	A	9	2
	Automatic knowledge acquisition; Machine learning	A	9	2
	Analogical reasoning; Explanation based learning	A	9	2
	Inductive learning; Knowledge acquisition tools	A	9	2
V	**Natural Language Processing** Computational model of language; Syntactic structure and analysis	A	15	3
	Case: Grammar; Grammar Types	A	15	2

	Natural language processing problems; Knowledge-based system approaches	A	15	2
	Machine translation; Divergence	A	15	2
	Revision			2
	Total Hours			**44**

Note: 100% Theory
CIA: 25 Marks; **End Semester:** 75 Marks

Text Book:

A. R.B.Mishra, *"Artificial Intelligence",* PHI Learning Private Limited, 2011.

References:

A. Elaine Rich, Kevin Night and Shivashankar B Nair, *"Artificial Intelligence"*, Tata McGraw Hill, Fifth Reprint, 2010.
B. Deepak Khemani, *"Artificial Intelligence"*, Tata McGraw Hill Education, 2013.
C. Dan W. Patterson, *"Introduction to Artificial* Intelligence and Expert Systems", PHI, 2013.
D. http://nptel.ac.in/courses/106105077/

Programme	Course Code	Title
M.Sc (ECS)	19ECP19B	Automotive Electronics

Preamble: This course is enables the students to promote the knowledge about the automotive engines and its techniques to familiarize the student to think about the advancement in automotive field.

Expected Level of Output : Analytical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory - Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Fundamentals of Automotive** Automotive Fundamental; Evolution; Physical Configuration; Automotive Systems	A	1	2
	Engine; Engine Block; Cylinder Head; 4 Stroke Cycle	A	1	2
	Engine Control; Ignition System; Ignition Timing	A	1	1
	Suspension; Brakes; Steering System	A	1	2
II	**Ignition Systems** Ignition fundamentals; Electronic ignition	B	8	2
	Programmed ignition: Electronic control unit	B	8	2
	Distributor less ignition; Direct ignition	B	8	1
	Diagnosing ignition system faults; New developments in ignition systems	B	8	2
III	**Electronic Fuel Injection** Combustion; Engine fuelling and exhaust emissions	B	9	1
	Electronic control of carburetion; Fuel injection	B	9	3
	Diesel fuel injection; Electronic unit injection	B	9	2
	Diagnosing fuel control system faults	B	9	2
IV	**Chassis Electrical System** Anti-lock Brakes; ABS Components; ABS control	B	15	2
	Active Suspensions; Traction control	B	15	1
	Automatic transmission; Other chassis electrical systems; New developments in chassis electrical systems	B	15	3
	Comfort and Safety Seats, mirrors and sun-roofs; Central locking and electric windows; Cruise control; Security; Air Bag and belt tensioners	B	16	4
V	**Intelligent Vehicle Technologies** Sensor technologies; Ultrasound sensors; Inertial sensors; LADAR; RADAR; Vision sensor; Global Navigation satellite system	C	4	4
	Embedded Protocols In-car embedded networks; CAN; VAN	C	4	1
	TT Networks; FlexRay Protocol; TTCAN protocol	C	4	2

	Low cost automotive networks; LIN Introduction of AUTOSAR	C	4	1
	Revision			4
	Total Hours			**44**

Note: 100% Theory
CIA: 25 Marks**; End Semester:** 75 Marks

Text Books:

A. William B. Ribbens, "*Understanding Automotive Electronics*", Society of Automotive Engineers Inc, Sixth Edition, 2003.
B. Tom Denton, "*Automobile Electrical and Electronic Systems*", Elsevier Publications Ltd., Third Edition, 2004.
C. Nicolas Navet, Francoise Simonot-Lion, *"Automotive Embedded systems Handbook",* Industrial Information Technology series, CRC press, Taylor and Francis Group, 2009.

References:

A. Ronald K. Jurgen, "*Automotive Electronics Handbook*", McGraw-Hill Professional, Second Edition, 1999.
B. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.95.4473&rep=rep1&type=pdf

Generic Elective Courses (GEC) Offered by the Department of Electronics and Communication Systems

Programme	Course Code	Title
M.Sc (SS)	19GEP20	Digital Electronics

Preamble: This course will introduce students to provide fundamental knowledge about number systems, combinational and sequential logic circuits.

Expected Level of Output : Conceptual Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory - Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Number System and Codes** Decimal, Binary, Octal and Hexadecimal numbers; Conversion	A	1	3
	Floating point representation	A	1	1
	Arithmetic operations	A	1	1
	1's and 2's complements	A	1	1
	Binary Coded Decimal (BCD); Weighted codes and Non-weighted codes	A	1	1
	Error detection codes; Error correction code	A	1	1
	Alphanumeric codes	A	1	1
II	**Boolean Algebra and Logic Gates** Boolean logic operations; Basic laws	A	2	1
	DeMorgan's theorem; Sum of Products and Products of Sums; Karnaugh map	A	2	2
	Logic Gates: OR; AND; NOT; NAND; NOR; EX-OR and EX-NOR, NAND and NOR as universal gates	A	3	1
	Logic Families Digital Integrated Circuits; Characteristics of Digital IC's	A	12	1
	Introduction to VHDL programming; VHDL Coding for Logic gates	B	13	2
III	**Combinational Logic Circuits** Half adder; Full adder; Half subtractor; Full subtractor	A	5	2
	Parallel binary adder; 4 bit binary adder / Subtractor; BCD adder	A	5	2
	Multiplexer; De-multiplexer; Decoders; Encoders	A	5	2
	Parity generators / checkers; Magnitude comparators	A	5	1
	BCD-to-Binary; Binary-to-BCD; Binary-to-Gray; Gray code-to- Binary converter circuits	A	5	2
	VHDL coding for combinational circuits	A	13	1
IV	**Sequential Logic Circuits** Flip-Flops: S-R FF; Clocked S-R FF; D FF; T-FF	A	6	2
	JK FF; Master-Slave Flip-Flops; Applications	A	6	1
	Parallel data storage; Frequency division	A	6	1

	Asynchronous/Ripple counter; Up/ down counter; Synchronous counter; Ring counter	A	7	2
	Decade counter; Design of MOD-3 and MOD-5 counters Applications: Frequency counter; Digital Clock	A	7	2
	Shift Registers and its types	A	8	1
V	**D/A, A/D Converters and Memories** DAC: Resistive divider type; Binary Ladder type; Accuracy and Resolution in DAC	B	13	3
	ADC: Counter type; Simultaneous type; Successive approximation type; Accuracy and Resolution in ADC	B	13	3
	Semiconductor memories and Classifications	A	13	1
	Revision			2
	Total Hours			**44**

Note: 80% Theory; 20% Problems
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. S. Salivahanan, S. Arivazhagan, "*Digital Electronics"*, Vikas Publishing House Pvt Ltd., First Edition, 2010.
B. Anil.K.Maini, "*Digital Electronics*", Wiley India Pvt. Ltd, First Edition, 2008.

References:

A. Donald P Leach, Albert Paul Malvino, GoutamSaha, *"Digital Principles and Applications"*, Tata McGraw Hill, Seventh Edition, 2011.
B. M. Morris Mano, *"Digital Design",* Prentice-Hall of India, Third Edition, 2005.
C. Bhasker. J, "*A VHDL Primer*", PHI Learning Pvt. Ltd., Third Edition, 2008.
D. http://nptel.ac.in/courses/117103064/
E. http://nptel.ac.in/courses/117106086/

Programme	Course Code	Title
M.Sc (SS)	19GEP21	Digital Electronics Lab

Preamble: This course allows students to impart the essential practical knowledge on the fundamentals and applications of digital circuits and digital computing principles.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : L (Practical-Experiments)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiments	
1	Verification of Logic Gates	
2	Binary to Grey and Grey to Binary Conversion	
3	Half Adder and Full Adder	
4	Half Subtractor and Full Subtractor	
5	4:1 Multiplexer using Gates	
6	1:4 De-multiplexer using Gates	
7	2x4 Decoder using Gates	
8	4x2 Encoder using Gates	
9	Decade Counter	
10	Digital to Analog Converter	
11	Analog to Digital Converter	
12	Logic Gates using VHDL	
	Repeat/Revision	**6**
	Total Hours	**36**

CIA: 40 Marks; **End Semester: 60** Marks

Note: Practical Classes to be arranged in Electronic Circuits Lab

Essential Equipments : Power Supply, CLK generator, CRO, Multi-meter.

Essential Software : Xilinx ISE/Active-HDL/Quartus-II

Programme	Course Code	Title
M.Sc (SS)	19GEP22	Embedded Systems

Preamble: This course equips students have basic knowledge and understanding in internal organization, programming and interfacing concepts of Intel 8-bit Microcontroller.

Expected Level of Output : Conceptual Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : F (Theory-Programming)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Definition of Basic Terminologies** **Computer Hardware:** Digital Computer; CPU; ALU; Control Unit; Memory; RAM; ROM; Peripherals; Input; Output; Microprocessor; Microcontroller; Bus; Address Bus; Data Bus; Control Signals	A	1	2
	Computer Languages: Bit; Byte; Nibble; Word; Instruction; Mnemonics; Program; Software; Machine Language; Assembly Language; Low level Language; High Level Language; Assembler; Compiler; Interpreter; Simulator; Integrated Development Environment (IDE)	A	1	3
	Microprocessor versus Microcontrollers	A	1	1
	Microcontrollers for Embedded Systems; Criteria for choosing microcontroller	A	1	2
II	**8051 Architecture and Memory organization** Overview of 8051 family; Architecture of 8051	A	1	2
	8051 Memory organization: RAM allocation; SFR and Program memory	A	2	2
	Flag bits and PSW register	A	2	1
	Program counter; Instruction fetching, decoding and execution concepts	A	2	2
III	**Embedded C Programming** C for Microcontrollers; Available C Compilers; Compilation Process	B	12	1
	Basic C Program Structure; Variables; Operators	B	12	2
	Loop Statements; Decision – IF statement; Decision – SWITCH statement	B	12	2
	C Extensions: Additional Keywords; C Extensions for 8051	B	12	1
	Accessing Specific Memory; C Data Types with Extensions	B	12	1
	Arrays in C; Pointers in C	B	12	2
IV	I/O Port Programming: Single bit operations using C	B	-	1
	Time delay programming using C	B	-	1
	Arithmetic and logic operations	B	-	2

	Square wave generation with frequency variation	B	-	1
	Interrupt programming and ISR	B	-	2
	Simple programs	B	-	1
V	**Real World Applications** Interfacing a Key; LED Interfacing	B	17&18	2
	Seven-segment display interfacing; LCD interfacing	B	18	2
	Traffic light control system; Interfacing ADC	B	19	2
	DC Motor interfacing; Stepper Motor interfacing	B	20	2
	Revision			4
	Total Hours			**44**

Note: 70% Theory; 30% Programs
CIA: 25 Marks; **End Semester:** 75 Marks

Text Books:

A. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, *"The 8051 Microcontroller and Embedded Systems using Assembly and C"*, Pearson, Second Edition, 2008.
B. Manish K Patel, *"The 8051 Microcontroller Based Embedded Systems",* McGraw Hill Education, 2014.

References:

A. Kai Qian, David den Haring and Li Cao, *"Embedded Software Development with C",* Springer, 2009.
B. Dogan Ibrahim, *"Microcontroller Projects in C for the 8051",* Newnes, First Edition, 2000.
C. Subrata Ghoshal, *"8051 Microcontrollers: Internals, Instructions, Programming and Interfacing",* Second Edition, Pearson Education India, 2014.
D. http://nptel.ac.in/courses/117104072/
E. http://nptel.ac.in/courses/1061081/

Programme	Course Code	Title
M.Sc (SS)	19GEP23	Embedded Systems Lab

Preamble: This course aims to provide students with the practical knowledge in 8051 programming for embedded systems.

Expected Level of Output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical - Application)

Course Inputs:

Any 10 Experiments

Exp.	Name of the Experiments	
	Embedded C Programming with 8051	
1	Arithmetic Operations	
2	Logical Operations	
3	Flashing LED	
4	Square Wave Generation with Frequency Variation	
5	4-bit Binary Counter	
6	Key and LED Interfacing	
7	Relay Interfacing	
8	DC Motor Interfacing	
9	Stepper Motor Interfacing	
10	Traffic Light Control System	
11	LCD Interfacing	
12	Analog to Digital Converter Interfacing	
	Repeat/Revision	**6**
	Total Hours	**36**

CIA: 40 Marks; **End Semester:** 60 Marks

Note: Practical Classes to be arranged in DSP Lab

Essential Equipments : PC/Laptop, Power supply, DSO, Multi-meter, 8051 MCU Project Board, Programmer Kit

Essential Software : KEIL IDE, Proteus Simulator/Any 8051 Simulator, Programmer software

Programme	Course Code	Title
M.Sc (SS)	19GEP24	PC Hardware

Preamble: This course equips students with basic knowledge about personal computers. The students can learn about PC hardware and software, maintenance and troubleshooting of PC systems.

Expected level of output : Conceptual and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory-Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Microcomputer System & Its Peripherals** Introduction; Computer organization; Memory	A	1	1
	Arithmetic and Logic unit; Control unit; Microprocessor; Operating system and its types	A	1	2
	Peripheral devices ; Keyboard; Mouse and trackball	A	2	2
	Scanner; CD-ROM drive; CRT monitor	A	2	2
	Printer; Functions; Characteristics; Dot matrix impact printer	A	2	2
	Laser printer, Inkjet printer	A	2	1
II	**PC Hardware** Hardware; BIOS; DOS interaction; The PC family: OG and NG; PC hardware; OG	A	3	2
	Inside the System Box SMPS; Motherboard; Motherboard components; Motherboard logic	A	3	3
	Front panel controls; Floppy disk controller; Hard disk controller; Post sequence	A	3	3
	BIOS set up; Sound card and MIDI	A	3	2
III	**Display Adapters** CRT display; CRT controller	A	11	2
	Color graphics adapter (CGA) CGA circuit description	A	11	2
	Second generation graphics adapters; New trends in display controllers; Display adapters; Device interface	A	11	2
	Serial Interfaces Data communication fundamentals; RS-232 interface	A	12	2
	Serial port in original PC; USB; Firewire (IEEE 1394)	A	12	2
IV	**Installation and Preventive Maintenance** System configuration; Pre-Installation planning; Installation practice	A	13	2
	Routine checks; PC Assembling and Integration	A	13	2
	BIOS setup; Standard CMOS setup	A	13	3
	Advanced chipset features setup; Preventive maintenance	A	13	2
	Problem causes; How DOS gets Control; DOS: The Resource Manager	A	13	2
V	**Troubleshooting** Computer faults; Nature and types of faults; Troubleshooting tools	A	14	2
	Bus faults; Faults elimination process	A	14	1

	Systematic Troubleshooting Symptoms, Observation and analysis	A	14	2
	Fault diagnosis; Fault rectification	A	14	2
	Virus; Data recovery tools from DOS	A	14	2
	Revision			5
	Total Hours			**55**

Note: 100% Theory
CIA: 25 Marks; **End Semester:** 75 Marks

Text Book:

A. B. Govindarajalu, *"IBM PC and Clones",* Tata McGraw Hill, Second Edition, 2010.

References:

A. D. Balasubramanian, *"Computer Installation and servicing"*, Second Edition, 2010.
B. Kai Hwang, *"Advanced Computer Architecture",* Tata McGraw Hill, 2008.
C. http://nptel.ac.in/courses/106106092/3
D. http://nptel.ac.in/courses/106106144/3

Programme	Course Code	Title
M.Sc (IT) & M.Sc (CT)	19GEP25	Robotics and Arduino Programming

Preamble: This course focuses on the topics in robotics that relate to fundamentals, actuators, grippers, and sensors of robot systems. This course will also explain how to use Arduino to operate lights, motors, and sensors for making a robot.

Expected level of output : Conceptual and Application Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : H (Theory-Technology)

Course Inputs:

Unit	Description	Text Book	Chapter	Instructional Hours
I	**Introduction to Robotics** History; Laws of Robotics; Robot definition	A	1	1
	Robot usage rules; Applications	A	1	1
	Robot subsystems: Motion subsystem; Recognition subsystem; Control subsystem	A	1	3
	Classification of Robots: Cartesian Robot; Cylindrical Robot; Spherical Robot; Articulated Robot	A	2	3
II	**Actuators** Classification of Actuators; Electric Actuators: Stepper motor	A	3	2
	DC Motors; Servo motor; Selection of motors	A	3	1
	Hydraulic Actuators; Pneumatic Actuators	A	3	2
	Grippers Mechanical Grippers; Magnetic Grippers	A	3	2
	Vacuum Grippers; Adhesive Grippers; Selection of grippers	A	3	1
III	**Sensors and Vision Systems** Sensor Classification; Internal Sensor; Position Sensors: Encoder, Potentiometer; LVDT	A	4	2
	Velocity Sensors: Tachometer, Hall-effect sensor	A	4	1
	Accelerometer and Gyroscope sensors	-	-	1
	Force Sensors: Strain-gauge sensor; Piezoelectric sensor	A	4	1
	Elements in a vision sensor; Steps in a vision system	A	4	1
VI	**Electronics for Robot** The Arduino platform; Functional block diagram of Arduino	B	-	1
	Arduino family of boards; Pin function of Arduino UNO	B	-	1
	Fundamentals of Arduino Programming; Keywords; Inbuilt functions; Libraries; Arduino Boot loader	B	-	2
	Digital GPIO programming; Working with pins as input and output; Working with PWM outputs	B	-	2
	Working with analog inputs using on-chip ADC; Serial communication between Arduino hardware and PC	B	-	2

V	**Robot Programming using Arduino** Blinking of LED; Key interfacing	C	-	1
	DC motor direction control; DC motor speed control using PWM; Servo motor control	C	-	2
	Interfacing LCD; Interfacing Ultrasonic sensor; Tone generation	C	-	2
	Line follower Robot; Obstacle avoider Robot	C	-	2
	PC control Robot; Wireless Robot	C	-	2
	Revision			5
	Total Hours			**44**

Note: 80% Theory; 20% Programs
CIA: 15 Marks; **End Semester:** 45 Marks

Text Books:

A. Subir Kumar Saha, *"Introduction to Robotics"*, McGraw-Hill Education, Second Edition, 2014.
B. Michael McRoberts, *"Beginning Arduino"*, Second Edition, Apress, 2013.
C. John-David Warren, Josh Adams, Harald Molle, *"Arduino Robotics"*, Apress, 2011.

References:

A. MikellGroover, Mitchell Weiss, Roger Nagel, Nicholas Odrey, Ashish Dutta, *"Industrial Robotics: Technology - Programming and Applications",* Tata McGraw-Hill Education, Second Edition (Special Indian Edition), 2012.
B. R.Mittle, I.Nagrath, *"Robotics and Control"*, Tata Mcgraw-Hill Education, 2003.
C. S.R. Deb, *"Robotics Technology and Flexible Automation"*, Tata McGraw Hill, Second Edition.
D. http://nptel.ac.in/courses/112103174/39

Programme	Course Code	Title
M.Sc (IT) & M.Sc (CT)	19GEP26	Robotics and Arduino Programming Lab

Preamble: This course aims to demystify the Arduino hardware and software through hands-on work in the laboratory and gives the knowledge on creating simple robots.

Expected level of output : Practical Level

Department offered : Electronics and Communication Systems

Modular Assessment Code : M (Practical - Application)

Course Inputs:

Any 10 Experiments

Exp. No	Name of the Experiment	
1	Blinking of LEDs	
2	LCD Interface	
3	Tone Generation	
4	Speed Control of DC Motor	
5	Position Control of Servo Motor	
6	Proximity Detector	
7	Accelerometer Interface	
8	Obstacle Avoiding Robot using Ultrasonic Sensor	
9	Line-following Robot	
10	Wireless Controlled Robot	
11	Self-balancing Robot	
12	Pick and Place Robot	
	Repeat/Revision	**6**
	Total Hours	**36**

CIA: 15 Marks; **End Semester:** 25 Marks

Note: Practical classes to be arranged in DSP Lab
Essential Equipments : Power Supply, CRO, Multi-meter and Arduino Board.
Essential Software : Arduino IDE.