Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM
(CBCS)

Syllabus: ELECTRONICS & TELECOMMUNICATION ENGINEERING

Name of the Course: M.Tech.- Semester I, II, III & IV

(Syllabus to be implemented w.e.f. 2023-24 & 2024-25)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
STRUCTURE OF M.Tech. (ELECTRONICS & TELECOMMUNICATION ENGINEERING)
Four Semester Course
Choice Based Credit System Syllabus w.e.f. 2023-24

Semester-I

Course Code	Subject	Teaching Scheme				Credits				Evaluation Scheme				
		L	T	P	Total	Credits (L)	Credits (T)	Credits (P)	Total Credits	Scheme	Theory Marks	ICA- P Marks	ICA-T Marks	Total Marks
EC 111	Research Methodology & IPR	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
EC 112	Antenna Theory & Techniques	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
EC 113	Advanced Embedded System	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
EC 114	Elective I	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
EC 115	Elective II	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
EC 116	Seminar- I	-	-	2	2	-	-	2.0	2.0	ISE	--	50	--	50
										ESE	--	--	--	
	Total	**15**	**2**	**8**	**25**	**15.0**	**2.0**	**5.0**	**22.0**		**500**	**125**	**50**	**675**

***Note :** L- Lectures, P-Practical, T-Tutorial, ISE- In Semester Evaluation, ESE- End Semester Evaluation, ICA- Internal Continuous Assessment.*

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Choice Based Credit System Syllabus w.e.f. 2023-24

Semester-II

Course Code	Subject	Teaching Scheme				Credits				Evaluation Scheme				
		L	T	P	Total	Credits (L)	Credits (T)	Credits (P)	Total Credits	Scheme	Theory Marks	ICA- P Marks	ICA-T Marks	Total Marks
EC 121	Advanced Light Wave Communication	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
EC 122	RF & Microwave Engineering	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
EC 123	Advanced IoT	3	-	2	5	3.0	-	1.0	4.0	ISE	30	25	--	125
										ESE	70	--	--	
EC 124	Elective – I	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
EC 125	Elective – II	3	1	-	4	3.0	1.0	-	4.0	ISE	30	--	25	125
										ESE	70	--	--	
EC 126	Seminar- II	-	-	2	2	-	-	2.0	2.0	ISE	--	50	--	50
										ESE	--	--	--	
	Total	**15**	**2**	**8**	**25**	**15.0**	**2.0**	**5.0**	**22.0**		**500**	**125**	**50**	**675**

Note : L- Lectures, P-Practical, T-Tutorial, ISE- In Semester Evaluation, ESE- End Semester Evaluation, ICA- Internal Continuous Assessment.

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

STRUCTURE OF M.Tech. (ELECTRONICS & TELECOMMUNICATION ENGINEERING)

Four Semester Course

Choice Based Credit System Syllabus w.e.f. 2023-24

- Seminar-I should be delivered on a topic related to student's broad area of interest for dissertation work selected in consultation with the advisor after compiling the information from the latest literature. Student should deliver seminar using modern presentation tools. A hard copy of the report (as per format specified by the department) should be submitted to the Department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.

- Seminar II should be delivered on a topic related to student's particular area of interest for dissertation work selected in consultation with the advisor after compiling the information from the latest literature. Student should deliver seminar using modern presentation tools. A hard copy of the report (as per format specified by the department) should be submitted to the Department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.

- **List of Elective Courses for semester I -**

Course Code	*Elective - I*	Course Code	*Elective – II*
EC 114.A	Biomedical Signal Processing	EC 115.A	Digital VLSI Design
EC 114.B	Soft Computing Methods	EC 115.B	Satellite Communication

- **List of Elective Courses for semester II -**

Course Code	*Elective - I*	Course Code	*Elective – II*
EC 124.A	Wireless Communication Systems	EC 125.A	Cryptography and Network Security
EC 124.B	Information and Coding Theory	EC 125.B	Automation and Industrial Robotics

***Note:** Courses may be added in the list of Elective I and II as and when required.*

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Four Semester Course

Choice Based Credit System Syllabus w.e.f. 2024-25

Semester-III

Course Code	Subject	Teaching Scheme		Credits			Evaluation Scheme			
		L	P	Credits (L)	Credits (P)	Total Credits	Scheme	Theory Marks	ICA Marks	Total Marks
SL001	Self-Learning Course	$	-	3.0	-	3.0	ISE	30	--	100
							ESE	70		
OE001	Open Elective Course#	3		3.0		3.0	ISE	30		100
							ESE	70		
EC 211	Dissertation Phase I : Synopsis Submission Seminar*		@4		3.0	3.0	ISE	--	100	100
							ESE	--	--	
EC 212	Dissertation Phase II : ICA*		-		3.0	3.0	ISE	--	100	100
							ESE	--	--	
EC 213	Dissertation Phase II Progress Seminar*		-		3.0	3.0	ISE	--		100
							ESE	--	100	
Total		**3**	**4**	**6.0**	**9.0**	**15.0**		**200**	**300**	**500**

Note : L- Lectures, P-Practical, T-Tutorial, ISE- In Semester Evaluation, ESE- End Semester Evaluation, ICA- Internal Continuous Assessment.

Note -

- $- Being a Self-Learning Course, student shall prepare for examination as per specified syllabus.
- *- For all activities related to dissertation Phase I (synopsis submission seminar and progress seminar) student must interact regularly every week with the advisor.
- Synopsis submission seminar shall cover detailed synopsis of the proposed work. Student shall submit synopsis of the dissertation work only after delivering seminar.
- Progress seminar shall be delivered capturing details of the work done by student for dissertation.
- Student should deliver all seminars using modern presentation tools. A hard copy of the report shall be submitted to the department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.
- @ Indicates contact hours of students for interaction with advisor.

List Self-Learning Courses -

Course Code	Self-Learning Subject
SL001.A	Design Thinking
SL001.B	Value Education & Professional Ethics
SL001.C	Cyber Security and Information Assurance

List of Open Elective Courses-

Course Code	Open Elective Subject
OE001.a	Business Analytics
OE001.b	Operation Research
OE001.c	Cost Management of Engineering Projects
OE001.d	Non Conventional Energy
OE001.e	Product Design & Development

Note: New Self Learning Courses and New Open Elective Courses may be added as and when required.

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Four Semester Course

Choice Based Credit System Syllabus w.e.f. 2024-25

Semester-IV

Course Code	Subject	Teaching Scheme			Credits			Evaluation Scheme		
		L	P	Total	Credits (L)	Credits (P)	Total Credits	Scheme	ICA Marks	Total Marks
EC 221	Dissertation Phase III : Progress Seminar #	-	4@	4	-	3.0	3.0	ISE	100	100
EC 222	Dissertation Phase IV: #	-	2@	2	-	6.0	6.0	--	200	200
EC 223	Final Submission of the Dissertation and Viva –Voce	-	-	-	-	6.0	6.0	ESE	200	200
	Total	-	-	**6**	**--**	**15.0**	**15.0**	**-**	**500**	**500**

Note –
- #- For all activities related to dissertation Phase III & IV student must interact regularly every week with the advisor.
- Progress seminar should be delivered capturing details of the work done by student for dissertation.
- Student shall deliver all seminars using modern presentation tools. A hard copy of the report should be submitted to the Department before delivering the seminar. A PDF copy of the report must be submitted to the advisor along with other details if any.
- Student must submit a hard copy of Project Report to the department.
- @ indicates contact hours of the student for interaction with the advisor.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-I

Choice Based Credit System (CBCS)

EC111 : RESEARCH METHODOLOGY and IPR

Teaching Scheme: **Examination Scheme:**
Lectures: 3 Hours/ week, 3 Credits   ESE: 70 marks
Tutorial: 1 Hour /week, 1 Credit   ISE: 30 marks
                                                                          ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction to Research:** Motivation and objectives, Research methods *vs.* Methodology, Types of research – Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical.	5
2	**Research Formulation:** Defining and formulating the research problem, Selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem, Literature review, Primary and secondary sources – reviews, treatise, monographs, patents, web as a source, searching the web, Critical literature review, Identifying gap areas from literature review, Development of working hypothesis.	8
3	**Research Design and Methods:** Research design – Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models, Developing a research plan, Exploration, Description, Diagnosis, and Experimentation, Determining experimental and sample designs.	8

		Section-II	
4	**Data Collection and Analysis:** Execution of the research, Observation and Collection of data, Methods of data collection, Sampling Methods, Data Processing and Analysis strategies - Data Analysis with Statistical Packages, Hypothesis-testing, Generalization and Interpretation.		8
5	**Reporting and Thesis writing:** Structure and components of scientific reports, Types of report, Technical reports and thesis, Significance, Different steps in the preparation – Layout, structure and Language of typical reports/thesis, Illustrations and tables, Bibliography, referencing and footnotes, Plagiarism, Citation and acknowledgement, Reproducibility and accountability.		8
6	**Ethics and IPR:** Environmental impacts, Ethical issues, ethical committees, Commercialization, Copy right, royalty, Intellectual property rights and patent law, Trade Related aspects of Intellectual PropertyRights, Reproduction of published material.		5

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 tutorials based upon above curriculum.

References:-

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications.2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications,Universal Law Publishing.
6. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
7. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries:the TRIPS agreement and policy options, Zed Books, New York.
8. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-I

Choice Based Credit System (CBCS)

EC112 : ANTENNA THEORY & TECHNIQUES

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hours /week, 3 Credits   ESE: 70 marks

Practical: 2 Hours / week, 1 Credit   ISE: 30 marks

                                                                    ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section- I	
1	**Antenna Arrays**: Linear arrays, planner arrays and circular arrays. Array of two isotropic point sources, non isotropic Sources. Principle of pattern multiplication linear arrays of n elements, broadside, End-fire radiation pattern, directivity, Beam-width and null directions, array factor.	10
2	**Micro strip Radiators:** Introduction, Advantages and limitations of micro strip antenna, Radiation mechanism of Micro strip antenna, Various micro strip antenna configurations, feeding mechanisms, Transmission line model, cavity model and Design consideration of rectangular micro strip antenna.	11

	Section- II	
3	**Broad banding of Micro strip Antenna:** Effect of substrate parameter on bandwidth, selection of shape of patch, selection of feeding technique: aperture coupled, transmission line model of aperture coupled antenna, broad banding using stacked elements, broad banding using coplanar parasitic elements and design examples.	8
4	**Design and Analysis of Micro strip Antenna Arrays:** Substrate characteristics for Microstrip Antenna Design, Ceramic Substrate, Semiconductor Substrate, Ferrimagnetic Substrate, Synthetic Substrate, Composite Material Substrate, Low-cost Low-loss Substrate and Desirable Substrate Characteristics for Antenna Fabrication, Parallel and series feed systems, Series feed of microstrip antenna, Mutual Coupling.	8
5	**Antennas for special applications:** Antennas design consideration for satellite communication, antenna for terrestrial mobile communication systems, Global Positioning System (GPS),WLAN (Wi-Fi),Bluetooth, Zigbee applications.	5

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 Laboratory Experiments based upon above curriculum using suitable **Modelling Software** for these experiments.

References:-

1. Antenna Theory analysis and design- Costantine A. Balanis, John Wiley publication.
2. Antennas-John D. Kraus, Tata McGraw Hill publication.
3. Antenna and wave propagation, Harish A. R., Oxford University Press.
4. Micro-strip antenna design handbook by Ramesh Garg, Prakash, Bhartia, InderBahl and Apisak Ittipiboon, Artech House, Boston, London.
5. Antenna Theory- Analysis and Design, Balanis C, 3rd Wiley,3rd, 2005.
6. Antenna Theory & Design - W. L. Stutzman and G. A. Thiele, 2nd Edition, Wiley, 1998.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-I

Choice Based Credit System (CBCS)

EC113 : ADVANCED EMBEDDED SYSTEM

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hours / week, 3 Credits	ESE: 70 marks
Practical: 2 Hours / week, 1 Credit	ISE: 30 marks
	ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Embedded Architecture:** Embedded computers, characteristics of embedded computing applications, challenges in embedded computing system design, embedded memories, embedded system design process, designing hardware and software components.	4
2	**Embedded Processor:** ARM11, About the processor Extensions to ARMv6, MP11 CPU overview, Debug and programming support, Power, Configurable options, Pipeline stages, Typical pipeline operations ,MP Core architecture with Jazelle technology, Parity checking support, Product revisions.	6
3	**Programmers Model:** About the programmer's model, Processor operating states, Instruction length, Data types, Memory formats, Addresses in an MP Core system, Operating modes, Registers, The program status registers, Exceptions, Control Coprocessor CP15, CP15 registers arranged by function, Summary of control coprocessor CP15 registers and operations, register descriptions, Summary of CP15 instructions.	10

	Section-II	
4	**Embedded system software:** Software architectures, software developments tools, programming concepts, embedded programming in C and C++, queues, stacks, optimization of memory needs, program modeling concepts, software development process life cycle and its model, software analysis, design and maintenance.	6
5	**Real time operating systems:** Real time operating systems (μC/OS)- real-time software concepts, kernel structure, task management, time management, inter task communication & synchronization, memory management, and porting μCos-II; Linux/RT Linux- features of Linux, Linux commands, file manipulations, directory, pipes and filters, file protections, shell programming, system programming, RT Linux modules, POSIX Threads, mutex management, semaphore management.	8
6	**Raspberry Pi:** Introduction to Raspberry Pi, ARM 11 Microcontroller Hardware Description & Interfacing Components, Hardware Interfacing of PI (HDMI Port, Keyboard mouse connection, 3.5mm audio jack, micro usb power cable) Programming the GPIO of Raspberry Pi, LCD interfacing.	6

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 practicals based on topics in the curriculum.

References:-

1. Embedded systems: a contemporary design tool, James K. Peckol- Wiley India.
2. Embedded Real Time Systems-Concepts, Design & Programming, Dr. K.V.K.K. Prasad, Dreamtech Publication.
3. ARM11 MPCore ™ Processor Revision: r2p0 , Technical Reference Manual.
4. Introduction to Embedded Systems, Jonathan W. Valvano , Cengage 2009.
5. Getting Started with Raspberry Pi By Matt Richardson, Shawn Wallace.
6. ARM System Developer's Guide, Sloss, Symes, Wright, Morgan, Kaufmann, 2004, 1st Edition.
7. ARM920T Technical Reference Manual (Rev 1) - ARM DDI 0151C, Data books of ARM7/ARM9 J., ARM Company Ltd.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-I

Choice Based Credit System (CBCS)

ELECTIVE-I   EC114. A : BIOMEDICAL SIGNAL PROCESSING

Teaching Scheme:

Lectures: 3 Hours / week, 3 Credits

Practical: 2 Hours / week, 1 Credit

Examination Scheme:

ESE: 70 marks

ISE: 30 marks

ICA: 25marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Biomedical signal origin and dynamics:** Action Potential and Its Generation, Origin and Waveform Characteristics of Basic Biomedical Signals Like: Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Phonocardiogram (PCG), Electroneurogram (ENG), Event-Related Potentials (ERPS), Electrogastrogram (EGG), Objectives of Biomedical Signal Analysis, Difficulties in Biomedical Signal Analysis, Computer-Aided Diagnosis.	4
2	**Removal of Noise and Artifacts:** Statistical Preliminaries, Time domain filtering (Synchronized Averaging, Moving Average), Time domain filtering (Moving Average Filter to Integration, Derivative-based operator), Frequency Domain Filtering (Notch Filter), Optimal Filtering: The Weiner Filter.	9
3	**EEG Signal Processing and Event** : EEG Signal Processing and Event Detection in Biomedical Signals, EEG Signal and Its Characteristics, EEG Analysis, Autoregressive Method, Sleep EEG, Application of Adaptive Filter for Noise Cancellation in ECG and EEG Signals; Detection of P, Q, R, S and T Waves in ECG, EEG	8

		Rhythms, Waves and Transients, Detection of Waves and Transients, Correlation Analysis Ad Coherence Analysis of EEG Channels.	
Section-II			
4		**Modeling of Biomedical systems:** Point processes- Parametric system modeling- All-pole, pole zero modeling, electromechanical models of signal generation. Analysis of non stationary signals: Characterization- Fixed segmentation- Short Time Fourier Transform-Adaptive segmentation Adaptive filters for segmentation- RLS and Lattice Filter.	9
5		**Introduction to medical image processing and visualization:** Human vision and perception,Two-dimensional Fourier transform, 2-D Convolution, 2-D filters, Image enhancement, Feature extraction, Edge detection.	5
6		**Advancement in Healthcare:** Introduction to CT, MRI, PET and SPECT, tumor types and their therapy, magnetic resonance imaging, Advancement in healthcare technologies. Case studies of biomedical signal and image processing.	7

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 Laboratory Experiments based upon above curriculum.

References:

1. D.C. Reddy, "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005.
2. Rangaraj M. Rangayyan, "Biomedical Signal Analysis: A case study Approach", Wiley Interscience 2002.
3. MetinAkay, "Biomedical Signal Processing", Academic press, Inc. California,1994.
4. Bruce, "Biomedical Signal Processing & Signal Modeling", Wiley, 2001.
5. Semmlow, Marcel Dekker "Biosignal and Biomedical Image Processing", 2004.
6. Enderle, "Introduction to Biomedical Engineering" , 2/e, Elsevier, 2005.
7. Tompkins W J "Biomedical Signal Processing", Prentice hall of India, New Delhi, 1999.
8. Bronzino J D "The Biomedical Engineering handbook", CRC and Free press, Florida, 1995.
9. Arnon Cohen "Biomedical Signal Processing", CrcPr I Llc; 2nd edition, May, 2002.

ELECTIVE-I   EC114.B : SOFT COMPUTING METHODS

Teaching Scheme:

Lectures: 3 Hours / week, 3 Credits

Practical: 2 Hours / week, 1 Credit

Examination Scheme:

ESE: 70 marks

ISE: 30 marks

ICA: 25marks

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Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction**: Introduction to Soft Computing, hard computing, Need for soft computing. Introduction to Fuzzy logic.	5
2	**Fuzzy Systems**: Fuzzy membership functions,Operations on Fuzzy sets, Fuzzy relations, Fuzzy propositions, Fuzzy implications, Fuzzy inferences, Defuzzification Techniques, Fuzzy logic controller.	8
3	**Genetic Algorithm:** Basic concepts, encoding, fitness function, reproduction, Differences of GA and traditional optimization methods.	8
	Section-II	
4	**Fundamentals of Neural Network:** Introduction, Model of Artificial Neuron, Architectures, Learning Methods, Taxonomy of NN Systems, McCulloch Pitts Neuron , Single-Layer NN System, Supervised Learning, Back-Propagation Learning, Back-Propagation Algorithm, Unsupervised Learning, Neural Networks, Competitive Learning Networks, Kohonen Self-Organizing Networks, Learning, Vector Quantization, Applications.	8
5	**Deep Learning-** History of Deep Learning, Deep Learning	7

	Success Stories, Introduction to Convolutional Neural Networks. Convolutional Neural Networks (CNN): convolution, filters, pooling, stride, drop out, layers, Recurrent Neural Networks (RNN), Variational Autoencoders, Generative Models, Applications.	
6	**Hybrid Systems:** Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms, GA Based Back Propagation Networks.	6

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 Laboratory Experiments based upon above curriculum.

References:

1. Melanic Mitchell, " An Introduction to Genetic Algorithm" (MIT Press).
2. S.N. Sivanandam& S.N. Deepa, "Principles of Soft Computing", Wiley Publications, 3rd ed., 2018.
3. Collelo, Lament, Veldhnizer, " Evolutionary Algorithm for Solving Multi- objective, Optimization Problems", (2nd Edition), (Springer).
4. Timothy J. Ross, " Fuzzy Logic with Engineering Applications" (Wiley).
5. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
6. Simon Haykin, " Neural Networks and Learning Machines" (PHI).
7. S. Rajasekaran & GA Vijayalakshmi Pai "Neural Networks, Fuzzy Logic, and Genetic Algorithms synthesis and application", PHI.
8. Ian Goodfellow and YoshuaBengio and Aaron Courville, " Deep Learning" An MIT Press book, http://www.deeplearningbook.org.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-I

Choice Based Credit System (CBCS)

ELECTIVE-II   EC115.A : Digital VLSI Design

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hours / week, 3 Credits   ESE: 70 marks

Tutorial: 1 Hour / week, 1 Credit   ISE: 30 marks

                                                                            ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**The CMOS Invertor:** Introduction, The static CMOS invertor, The Dynamic Behavior of CMOS invertor, Power and Energy Delay.	5
2	**Designing Combinational Logic in CMOS:** Introduction, Static CMOS design- Complementary Logic, Ratioed Logic, Pass Transistor Logic. Dynamic CMOS Design- Pre-charge & evaluation, Speed and Power Dissipation, Cascading Dynamic Gates, Designing Logic for Reduced Supply Voltages.	8
3	**Designing Sequential Logic Circuits:** Basic concepts, Bi-stability principle, Static & dynamic latches and registers, Non-Bistable Sequential circuits - The Schmitt Trigger, Monostable Sequential Circuits, A-stable Circuits.	8
	Section-II	

4	**Implementation Strategies for Digital ICs:** Introduction, Cell-Based Design Methodology-Standard Cell, Compiled Cells, Macrocells, Megacells and Intellectual Property, Semi-Custom Design Flow, Array-Based Implementation Approaches-Pre-diffused (or Mask-Programmable) Arrays, Pre-wired Arrays.	8
5	**Designing Arithmetic Building Blocks:** The Adder, The Multiplier, The Shifter, Other Arithmetic Operators, Power and Speed Trade-off's in Datapath Structures.	7
6	**Designing Memory and Array Structures:** Classification of semiconductor memories, Memory Peripheral Circuitry-The Address Decoders, Sense Amplifiers, Voltage References, Drivers/Buffers, Timing and Control. Case Studies in Memory Design-The Programmable Logic Array (PLA), A 4 Mbit SRAM, A 1 Gbit NAND Flash Memory	6

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 tutorials based on topics in the curriculum.

References:-

1. Rabey, Chandrakasan, Nikolic ,"Digital Integrated Circuits", Pearson Education.
2. Neil H. E. Weste, David Harris, Ayan Banerjee," CMOS VLSI design" Pearson Education.
3. Wayne Wolf, " Modern VLSI Design".
4. Timothy J. Ross, " Fuzzy Logic with Engineering Applications" (Wiley).
5. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam "Essentials of VLSI Circuits and Systems" – PHI, EEE, 2005 Edition.

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M.Tech. (Electronics & Telecommunication Engg.) Semester-I

Choice Based Credit System (CBCS)

ELECTIVE-II EC115.B : Satellite Communication

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hours / week, 3 Credits   ESE: 70 marks

Tutorial: 1 Hour / week, 1 Credit   ISE: 30 marks

                                                                                    ICA: 25 marks

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Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction to Satellite Communication, Orbit Mechanism and Launchers:** *Introduction* – Introduction to satellite communication, frequency allocation. *Orbital Mechanism*- Introduction, basic principle, Kepler's laws, Orbiting parameters-apogee, perigee, orbital time, velocity, sub-satellite point, types of satellite orbit (LEO, MEO, GEO), orbital perturbations, numerical on orbital parameters. *Launchers*- Launch vehicle introduction, Satellite launch vehicle (SLV), Polar Satellite launch vehicle (PSLV), Geo-Satellite launch vehicle (GSLV).	8
2	**Satellite subsystems:** Satellite subsystems, attitude and orbit control system (AOCS), Telemetry, Tracking command and monitoring, power system, communication subsystem, antenna subsystem, equipment reliability and space qualification.	6

3	**Satellite Link Design:** Introduction, basic transmission theory, system noise temperature and G/T Ratio, design of downlinks, uplink design, design of specified C/N-Combining C/N and C/I values in satellite links, system design examples.	7
	Section-II	
4	**Earth station:** Introduction, Types of earth stations- FSS, BSS, MSS, single frequency station, Gateway station, earth station architecture, earth station design consideration, performance parameters, optimization, earth station testing, R.F. equipment for earth station.	6
5	**Propagation effects:** Introduction, atmospheric absorption, cloud attenuation, tropospheric & ionospheric Scintillations &low angle fading, rain induced attenuation.	8
6	**Satellite Navigation and Global Positioning system (GPS):** Introduction, radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, VSAT. Home satellite TV, Digital DBS TV, satellite radio broadcasting.	7

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 tutorials based on topics in the curriculum.

References:

1. Satellite communication-Timothy Pratt, Charles Bostian, Jeremy Allnutt- John Wiley & Sons (2nd Edition).
2. Satellite Communication-Anil K. Maini, Varsha Agrawal- Wiley India PVT Ltd.
3. Satellite Communication- Dennis Roody- McGraw Hill.
4. Satellite communication- Manjit Mitra- PHI Learning PVT Ltd.
5. Satellite communication- systems- Gerard Maral, Michel Bousquet - John Wiley & Sons.
6. Satellite Communication- K.N. Raja Rao- Prentice Hall of india.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-II
Choice Based Credit System (CBCS)
EC121: ADVANCED LIGHT WAVE COMMUNICATION

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hours/ week, 3 Credits   ESE: 70 marks

Practical: 2 Hours /week, 1 Credit   ISE: 30 marks

                                                                   ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction to guided optical communication:** Optical Fibers, types of fibers & optical Cables, Study of losses during transmission through viz. Attenuation by Absorption & Scattering, Consideration of losses in designing of High Speed / High bandwidth optical communication systems, Selection of fiber for such systems.	8
2	**Optical Sources:** Types of LEDs used in optical communication, their construction & operating principle, Types of Lasers. Principle of working of Lasers, solid state & injection Lasers, Optical amplifiers, EDFA, Soliton Systems & design of system required in LAN & WAN type of applications. Calculations of Power budgets and feasibility of system design for above optical sources.	7
3	**Optical Detectors:** Introduction & study of type of detectors characteristics, Spectral spread and availability of detectors for 980 nm, 1.3 µm & 1.55 µm λ systems. Calculation of detector sensitivity and design considerations of suitable receivers for LAN, WAN applications.	8
	Section-II	
4	**Multiplexing Components & Techniques**: Concepts of WDM, DWDM system design parameters, Optical multiplex / Demultiplex design considerations- Angular dispersive devices, Dielectric thin film filter type devices, Hybrid & planer wave guide devices,	8

	Active WDM devices, Wavelength non selective devices.	
5	**Long Haul High Band Width Tx System :** Designing systems for long haul high band width consideration-Outage, Bit error rate, Cross connect, Low & high speed interphases, Multiplex / Demultiplex consideration, Regenerator spacing, Degeneration & Allowances, Application consideration.	8

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 experiments based on above curriculum.

Reference Books:-

1. Optical Communication Systems by John Gowar (PHI)
2. Optical Fiber Communication by Gerd Keiser (MGH)
3. Optical Fiber Communication Principles & Practice by John M. Senior (PHI pub. 1996.)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-II

Choice Based Credit System (CBCS)

EC122: RF & Microwave Engineering

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hours/ week, 3 Credits   ESE: 70 marks

Practical: 2 Hours /week, 1 Credit   ISE: 30 marks

ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Two port Network :** Two-Port Parameters, S-Parameters, S-Parameters from Spice Analysis, Stability, Power Gains, Voltage Gains and Current Gains, Derivation of Transducer Power Gain and Differential S-Parameters	6
2	**Active RF Components:** RF Diode Characteristics – Schottky Diodes and Detectors, PIN Diodes and Control Circuits, Varactor Diodes, Other Diodes RF Transistor Characteristics – Field Effect Transistors(FETs), Bipolar Junction transistors(BJTs)	6
3	**Microwave Amplifier Design** Introduction, Single-Stage Amplifier Design- Design for Maximum Gain (Conjugate Matching), Design for Specified Gain, Low – Noise Amplifier Design Power Amplifier Design – Characteristics of Power Amplifiers and Amplifier Classes, Large Signal Characterization of Transistors, Design of Class A Power Amplifiers.	8
	Section-II	
4	**Microwave Oscillator design :** Two-Port Oscillator Design, Negative Resistance from Transistor Model, Oscillator Q and Output power, Transistor Oscillator Design	8

5	**Filter Design :** Introduction, Periodic Structures, Filter Design- Image-Parameter Method, Insertion-Loss Method, Filter Implementation- Richard's Transformation, Kuroda's Identities.	6
6	**Monolithic Microwave Integrated Circuits & Technology :** Introduction, History of Monolithic Microwave Integrated Circuits, Materials, Fabrication techniques of MMIC.	6

Internal Continuous Assessment (ICA)

Term work shall consist of any six experiments based on above curriculum.

Reference Books:

1. David.M. Pozar, "Microwave Engineering", John Wiley & Sons, New York, 2005.
2. Reinhold Ludwig, Pavel Bretchko, "RF circuit design, theory and applications", Pearson Asia Education, 2nd Edition, 2012.
3. Microwave Devices and Circuits- Samuel Y. Liao, (PHI)-Facsimile, 14 March 1990.
4. Microwave Circuit Design Using Linear and Nonlinear– 11 June 2021 by George D. Vendelin , Anthony M. Pavio , Ulrich L. Rohde , Matthias Rudolph (Author)- John Wiley & Sons publication.
5. Mathew M. Radmanesh, "Radio Frequency and Microwave Electronics", Pearson Education Asia, 2001.

List of Experiments:

Design and simulation of any one microwave device as directional coupler, magic-Tee, microwave filters etc; and analysis of S-parameter, Power Gain, Input Impedance of the respective device using any microwave simulation software as HFSS, FEKO, IE3D and detailed report should be submitted at the end of semester.

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M.Tech. (Electronics & Telecommunication Engg.) Semester-II

Choice Based Credit System (CBCS)
EC123: ADVANCED INTERNET OF THINGS

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hours/ week, 3 Credits   ESE: 70 marks

Practical: 2 Hours /week, 1 Credit   ISE: 30 marks

                                                                              ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction to Internet of Things :** Introduction to IoT, different components of an IoT system: embedded systems, sensors, communication systems, cloud, applications of IoT in various domains.	5
2	**Industrial Internet of Things (IIoT):** IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.	6
3	**Introduction to ARM:** Introduction to ARM architecture, cortex series classification (A, R, M series), ARM Cortex-M series family, ARM Cortex-M3 processor overview, block diagram, registers, memory map, instruction set: data accessing, processing, arithmetic, basic embedded C programs for on-chip peripherals, interfacing I/O devices like LEDs, switches etc., serial communication, analog interfacing and data acquisition, concepts of application programming interface (API).	10

	Section-II	
4	**Communication technologies for IoT:** Basics of the communication technologies like Bluetooth Low Energy (BLE), Zigbee, Wifi, RFID,their architecture, characteristics, limitation, power consumption parameters and applications	8
5	**Application protocols for IoT:** Basics of application protocols like MQTT and CoAP, their features, framework, message formats, implementations and applications.	8
6	**Cloud platforms for IoT:** Cloud architecture for IoT, concept of APIs, survey of various IoT cloud platforms,understanding the costing structure of cloud for IoT services, performance metrics for cloud platforms in IoT.	5

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum six experiments based on above curriculum.

Text Books:

1. Internet of Things by Raj Kamal
2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu
3. Internet of Things for Architects by Perry Lea
4. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0 by Giacomo Veneri and Antonio Capasso.
5. Practical Industrial Internet of Things Security: A practitioner's guide to securing connected industries by Sravani Bhattacharje.
6. Analytics for the Internet of Things (IoT) by Andrew Minteer
7. Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers: A Practical Approach, Embedded Systems Fundamentals with ARM Cortex-M based Microcontrollers: A Practical Approach, Alexander G. Dean.

Reference Books:

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf.
2. Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry by MaciejKranz, Wiley Publication.
3. MQTT Essentials - A Lightweight IoT Protocol by Gaston C. Hillar.
4. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher.
5. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed by Perry Xiao.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-II

Choice Based Credit System (CBCS)

ELECTIVE-I:EC 124.A: Wireless Communication Systems

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hours/ week, 3 Credits	ESE: 70 marks
Tutorial: 1 Hour /week, 1 Credit	ISE: 30 marks
	ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction to Wireless Communication System:** Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trends in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area Network (WLAN), Bluetooth and Personal Area Networks.	5
2	**The Cellular Concept- System Design Fundamentals:** Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co- channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations.	8
3	**Mobile Radio Propagation Model, Small Scale Fading and diversity:** Large scale path loss:- Free Space Propagation loss equation, Path- loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation.	8

		Section-II		
4	**Multiple Access Techniques:** Introduction, Comparisons of multiple Access Strategies TDMA, CDMA, FDMA, OFDM, CSMA Protocols.			5
5	**Wireless Systems:** GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, CDMA2000 cellular technology,GPRS system architecture.			8
6	**4G (LTE) & 5G Next Generation Technology:** Introduction to 4G, LTE Architecture, Elements of LTE- EPS, LTE Radio / air interface- Modulation and features, LTE Channels, Introduction to 5G, 5G CN Architecture			8

Internal Continuous Assessment (ICA)

 ICA shall be based upon minimum 6 tutorials based on above curriculum.

Reference Books:-

1 Wireless Communication, Theodore S. Rappaport, Prentice hall.

2 Wireless Communications and Networking, Vijay Garg,Elsevier.

3 Wireless digital communication, Kamilo Feher, PHI.

4 Mobile Communications Engineering,William C. Y. Lee, Mc Graw Hill Publications.

5 Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).

6 Wireless Communications-T.L.Singh-TMH.

7 Adhoc MobileWireless network, C.K.Toh Pearson.

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M.Tech. (Electronics & Telecommunication Engg.) Semester-II

Choice Based Credit System (CBCS)

ELECTIVE-I :EC 124.B: Information and Coding Theory

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hours/ week, 3 Credits	ESE: 70 marks
Tutorial: 1 Hour /week, 1 Credit	ISE: 30 marks
	ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction:** Introduction to probability, uncertainty and information, entropy; Joint and conditional entropies, Mutual information.	5
2	**Linear Block Codes:** Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes, Applications of Block codes for Error control in data storage system.	8
3	**Cyclic Codes:** Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.	8
	Section-II	
4	**Convolutional Codes:** Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes, Application of Viterbi Decoding and Sequential Decoding, Applications of Convolution codes in ARQ system.	8

5	**BCH Codes:** Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.	5
6	**Source Coding :** Introduction to data compression, lossless and lossy compression, entropy coding; Huffman code, Shannon-Fano code, Arithmetic code, Run-length code, Lempel-Ziv code.	8

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 tutorials based upon above curriculum.

Reference Books:-

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.

2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

3. T.M. Cover and J.A. Thomas, "Elements of Information Theory", 2nd edition.,Wiley Interscience.

4. R. Bose, "Information Theory, Coding and Cryptography", Tata McGraw Hill.

5. K. Sayood, "Introduction to Data Compression", 5th edition, Morgan Kaufmann.

6. S. Roman, "Coding and Information Theory", Springer.

7. R.E. Blahut, "Principles and Practice of Information Theory", Addison- Wesley Publishing Company.

8. Digital Communications- John G. Proakis, 5th ed., , TMH 2008.

9. Introduction to Error Control Codes-Salvatore Gravano-oxford.

10. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.

11. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.

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M.Tech. (Electronics & Telecommunication Engg.) Semester-II

Choice Based Credit System (CBCS)

ELECTIVE-II:EC 125.A: CRYPTOGRAPHY & NETWORK SECURITY

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hours/ week, 3 Credits	ESE: 70 marks
Tutorial: 1 Hour /week, 1 Credit	ISE: 30 marks
	ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Overview:** Services, Mechanisms, and attacks, The OSI Security Architecture, A model for network security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Mechines, Steganography	7
2	**Block Ciphers and the Data Encryption Standard:** Ciphers: Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, Confidentially using symmetric Encryption: Placement ofEncryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation	9
3	**Public Key Cryptography and RSA:** Principles of Public Key cryptosystems, The RSA Algorithm, Key Management, other Public Key, Cryptosystems key Management, Diffle-Hellman Key exchange.	5
	Section-II	
4	**Message Authentication and hash functions:** Authentication Requirements, Authentication Function, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs.	7
5	**Hash Algorithms:** MD5 Message Digest Algorithm, Secure Hash Algorithm.	7
6	**Electronic Mail Security:** Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentifications, Header, Encapsulating Security Payload, Combining Security Associations, Key Management.	7

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum six tutorials based on above curriculum.

Reference Books:

1.Willam Stallings, Cryptography and Network Security , Third Edition, Pearson Education
2.Cbarlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Private Communicationin a public world, Second Edition, Pearson Education Asia, 2002.
3.Atul Kahate, Cryptography and Network Security, Tata Mc Grawhill, 2003.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M.Tech. (Electronics & Telecommunication Engg.) Semester-II

Choice Based Credit System (CBCS)

ELECTIVE-II: EC 125.B: AUTOMATION AND INDUSTRIAL ROBOTICS

Teaching Scheme:

Lectures: 3 Hours/ week, 3 Credits

Tutorial: 1 Hour /week, 1 Credit

Examination Scheme:

ESE: 70 marks

ISE: 30 marks

ICA: 25 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction:** Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, Automated Inspection, Principles and Methods Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break- Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in-process.	4
2	**PLC:** Introduction-Programmable Logic controller, Ladder Logic, Programming, PLC connection, Ladder Logic Inputs , Ladder Logic outputs, PLC Hardware- I/O, relay, electric wiring. Logical sensors & actuators.	4
3	**PLC Operation:** Operation Sequence, PLC status, memory types, software based PLCs, ladder logic functions,advanced ladder logic functions.	4
4	**Introduction to SCADA:** Introduction to Wide Area SCADA System, SCADA System Hardware, SCADA System Software, Communication Protocols, Serial Communications for SCADA Systems, LAN/WAN Communication for SCADA Systems.	4
	Section-II	

5	**Introduction :** Definition of Robot & Robotics, Types of industrial robot and their methods of operation, Methods of teaching and programming, Types of controller and program memory, Analysis and control.	3
6	**Actuators & sensors for robots:** Pneumatic & Hydraulic actuation, Hydrostatic circuits, Electric actuation, Mechanical transmission methods, Sensors for Joint angle, Joint angular velocity , Rectilinear position , Force and torque, Proximity sensing and range measurement , touch sensing & Vision.	6
7	**Control, Programming and Intelligence:** Introduction, History of Design of Robot Controllers, Motion Planning and Control of Robots, Intelligent Control of Robot Mobility, On-line & offline Programming, Neuro-fuzzy Systems.	6
8	**Applications of Industrial Robots:** Machine loading, Pallet loading and unloading, Investment casting, Spot welding , Arc welding,Spraying (paint, enamel, epoxy resin and other coatings), Fettling (grinding, chiseling),polishing, Cutting, Inspection, Mobile robots, Robotics and artificial intelligence.	3

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum 6 tutorials based upon above curriculum.

Reference Books:

1. "Automation, Production Systems and Computer Integrated Manufacturing"-P.Grover, Pearson Education
2. " Automating Manufacturing system with PLC", Hugh Jack, Edition 4, 2005
3. "Practical SCADA Systems for Industry", IDC technologies
4. "Fundamentals of Robot Technology" , D J Todd, Kogan Page Ltd
5. "Handbook of Industrial Robotics", Shimon Y. Nof, John Wiley & Sons

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)
Self-Learning Subject (SL001.A) : DESIGN THINKING

Credits: 3

Examination Scheme:
ESE:70 marks
ISE: 30 marks

Unit No.	Details	Teaching Hours
	Course content	
	Section-I	
1	**Design Thinking Skills:** Morals, Values and Ethics - Integrity, Work Ethics - Service Learning - Civic Virtue - Respect for others - Living Peacefully - Caring - sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy – Self-Confidence - Character – spirituality, Difference between design thinking and other traditional approaches, Design Thinking Skills, Application of these skills with some example, Design Thinking Mindset, Principles of Design Thinking, Exercises and case based discussions.	6
2	**Listening and Empathizing Techniques:** Design Thinking Frameworks, Ideation tools – brainstorming, innovation heuristics, behavior models, overcoming cognitive fixedness; Apply creativity, brainstorming, and concept generation process in designing needs solutions, Explore prototyping methods, strategies– Exercises and case based discussions.	12
	Section-II	
3	**Design for Services:** Understand design of services, Principles of service design thinking, Use of Diagrams and Maps in Design Thinking – Empathy map, Affinity diagram, mind map, journey map, combining ideas into complex innovation concepts, Assess developer and user perspectives for bias – apply frameworks to strengthen Communication – sustain a culture of innovation.	10
4	**Product Architecture and Financial Analysis:** Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications, financial analysis of business idea. Learn how to apply design for environment principles to a product life cycle – Exercises and case based discussions.	10

Reference Books:

1. Karl T. Ulrich and Steven D. Eppinger. Product design and development, McGraw-Hill

2. "Designing for growth: A design thinking tool kit for managers", Jeanne Liedtka and Tim Ogilvie., 2011, ISBN 978-0-231-15838-1

3. "The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems", by Michael Lewrick, Patrick Link, Larry Leifer., 2018, ISBN 978-1-119-46747-2

4. Roger Martin ; The Design of Business: Why Design Thinking is the Next Competitive Advantage ,Harvard Business Press , 2009.

5. "Presumptive design: Design provocations for innovation", by Leo Frishberg and Charles Lambdin., 2016, ISBN: 978-0-12-803086-8

6. "Systems thinking: Managing chaos and complexity: A platform for designing business architecture.", "Chapter Seven: Design Thinking", by Jamshid Gharajedaghi, 2011, ISBN 978-0-12-385915-0

7. Websites:https://www.gasq.org/files/content/gasq/downloads/certification/Design%20Thinking/ DesignThinking_Syllabus_0-6-3_EN.pdf

8. Jeanne Liedtka , Andrew King, Kevin Bennett , "Book - Solving Problems with Design Thinking - Ten Stories of What Works" (Columbia Business School Publishing), 2013

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)
**Self Learning Subject (SL001.B):VALUE EDUCATION &
PROFESSIONAL ETHICS**

Examination Scheme:

Credits: 3

ESE: 70 marks

ISE:30 marks

Unit No.	Details	Teaching Hours
	Course content	
	Section-I	
1	**Human Values:** Morals, Values and Ethics - Integrity, Work Ethics - Service Learning ,Civic Virtue, Respect for others , Living Peacefully , Caring , sharing , Honesty , Courage,Valuing Time, Cooperation, Commitment, Empathy,Self-Confidence, Character, spirituality	7
2	**Philosophy of life and individual qualities:** Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis,Regulating desire , Guarding against anger - To get rid of Anxiety The Rewards of Blessing - Benevolence of Friendship, Love and Charity, Self – tranquility/Peace.	8
3	**Social Values (Individual and Social Welfare):** Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood, Five responsibilities/duties of Man : a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftiness (Thrift)/Economics. Health - Education Governance, People's Responsibility / duties of the community, World peace.	6
	Section-II	
4	**Engineering Ethics:** Senses of Engineering Ethics - Variety of Moral Issues ,Types of inquiry, Moral Dilemmas Moral Autonomy, Kohlberg's Theory, Gilligan's Theory - Consensus and Controversy, Models of Professional Roles, Theories about Right Action ,Self-Interest - Customs and Religion.	7
5	**Professional Practices in Engineering:** Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in	7

	Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession, Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.	
6	**Global issues in Professional Ethics:** Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.	7

Reference Books:

1. Bayles, M.D.: Professional Ethics, California: Wadsworth Publishing Company, 1981.
2. Koehn, D.: The Ground of Professional Ethics, Routledge, 1995.
3. R.S. Naagarazan, A Text Book of Professional Ethics & Human Values, New Age International, 2006.
4. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
5. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2E, Cambridge University Press 2015.
6. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications.
7. Camenisch, P.F.: Grounding Professional Ethics in a Pluralistic Society, N.Y.: Haven Publications, 1983.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M. Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)
Self-Learning Courses
SL001.C: CYBER SECURITY AND INFORMATION ASSURANCE

Credits- 03 Credit

Examination Scheme:
ESE: 70 marks
ISE: 30 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Overview of Cyber security:** Cyber security increasing threat landscape, Cyber security terminologies- attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker, Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare	6
2	**Introduction to Cyber security :** Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Issues and challenges of cyber security.	6
3	**Cyber crime and Cyber law:** Classification of cyber crimes, Common cyber-crimes- cyber-crime targeting computers and mobiles, cyber-crime against women and children, financial frauds, social engineering attacks, malware and ransom ware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber-crimes, Remedial and mitigation measures, Legal perspective of cyber-crime, IT Act 2000 and its amendments, Cyber-crime and offences, Organizations dealing with Cyber-crime and Cyber security in India	8
	Section-II	
4	**Data Privacy and Data Security:** Defining data, meta-data, big data, non- personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security Issues.	7

5	**Introduction to block chain :** Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.	7
6	**Bitcoin:** Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks -double spending - mathematical analysis of properties of Bitcoin	7

Reference Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.
5. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.
6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.
7. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
8. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
9. Fundamentals of Network Security by E. Maiwald, McGraw Hill.
10. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton UniversityPress (July 19, 2016).
11. Melanie Swan : Blockchain : Blueprint for a New Economy : 2015

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)

Open Elective Course (OE001.a):BUSINESS ANALYTICS

Teaching Scheme: **Examination Scheme:**
Lectures: 3 Hours/ week   ESE: 70 marks
Credits- 3   ISE: 30 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction:** What Is Business Analytics? Business Analytics Process, Relation of BA process and Organization decision making process What is Data Mining? Data Mining and Related Terms, Big Data, Data Science, Terminology and Notation in Data mining	4
2	**Overview of the Data Mining Process:** Core Ideas in Data Mining, Classification, Prediction, Association Rules and Recommendation Systems, Predictive Analytics, Data Reduction and Dimension Reduction, Data Exploration and Visualization, Supervised and Unsupervised Learning, Steps in Data Mining, Organization of Data sets	5
3	**Data Visualization:** Uses of Data Visualization, Basic Charts: Bar Charts, Line Graphs and Scatter Plots, Distribution Plots: Box plots and Histograms, Heat maps: Visualizing Correlations and Missing Values, Multidimensional Visualization: Adding Variables: Color, Size, Shape, Multiple Panels, and Animation Manipulations: Rescaling, Aggregation and Hierarchies, Zooming, Filtering, Reference: Trend Lines and Labels, Scaling up to Large Datasets	5
4	**Dimension Reduction :** Introduction, Curse of Dimensionality, Data Summaries, Summary Statistics, Aggregation and Pivot Tables, Correlation Analysis, Reducing the Number of Categories in Categorical Variables, Converting a Categorical Variable to a Numerical Variable, Principal Components Analysis	4
	Section-II	

5	**Performance Evaluation :** Evaluating Predictive Performance, Naive Benchmark: The Average, Prediction Accuracy Measures Comparing Training and Validation Performance, Lift Chart, Judging Classifier Performance, Benchmark: The Naive Rule, Class Separation, The Confusion (Classification) Matrix, Using the Validation Data, Accuracy Measures.	5
6	**Multiple Linear Regression:** Explanatory vs. Predictive Modeling, Estimating the Regression Equation and Prediction, Variable Selection in Linear Regression, Reducing the Number of Predictors	4
7	**Classification & Regression Trees:** Introduction, Classification Trees, Recursive Partitioning, Measures of Impurity, Tree Structure, Classifying a New Record, Evaluating the Performance of a Classification Tree, Navie Bayes Classifier Regression Trees : Prediction, Measuring Impurity, Evaluating Performance Advantages and Weaknesses of a Tree	5
8	**Clustering:** Introduction Feature selection for clustering: Filter models and Wrapper models, k-Means algorithm	4

Reference Books:
1. Data Mining for Business Analytics - Concepts, Techniques, And Applications In R, Galit Shmueli Peter C. Bruce Inbal Yahav Nitin R. Patel Kenneth C. Lichtendahl, Jr., Wiley Publication
https://edu.kpfu.ru/pluginfile.php/274079/mod_resource/content/2/DatMiningBusAnalytics.pdf
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services (2015)
3. Business Analytics – Principles, Concepts and Applications, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson Education Limited
4. Data Mining : The Textbook, Charu C. Agrawal, Springer Publications

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)
Open Elective Course(OE001.b) OPERATION RESEARCH

Teaching Scheme: **Examination Scheme:**
Lectures: 3 Hours/ week   ESE: 70 marks
Credits- 3   ISE: 30 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**OR Models:** Model formulation, Linear Programming models, Graphical solution, Simplex techniques, Two Phase method	5
2	**Duality theory** : Properties of Primal and Dual Optimal Solutions, Duality Simplex method , Shadow Price- Sensitivity analysis	5
3	**Simulation Techniques** : Need of Simulation techniques , Monto-Carlo Simulation, random number concept, applications of Simulation technique	5
4	**Queuing Models** : Introduction, Structure of queuing system, Terminology (Kenda's Notations) and Applications. Queuing Model M/M/1: /FIFO	5
	Section-II	
5	**Inventory control :** Inventory costs, Economic order quantity, and deterministic models with or without shortages - probabilistic models - Price break model, Selective Inventory management techniques.	5
6	**Replacement analysis:** Replacement models - Replacement policy for items considering change in money value with time - Individual replacement policy - Group replacement policy	5
7	**Network flow models :** Minimal Spanning Tree problems -Shortest route problems -Dijiktra's algorithm - Maximal Flow problem	5
8	**PERT and CPM Networks** : Floats and applications - Network crashing - Cost optimization - Resource allocation and scheduling	5

Reference Books:
1. Operations Research by Hillier and Lieberman TMGH
2. HamdyTaha, "Operations Research – An Introduction", 7th edition PHI (2003)
3. S. D. Sharma, "Operation Research", Kedarnath and Rannalt Pub.
4. Hira and Gupta, "Operation Research", S. Chand and Co.
5. N. D. Vohra, "Quantitative Techniques in Management", TMGH
6. Shrinath L.S.: PERT & CPM –Affiliate East West Press
7. Anand Sharma " Quantitative Techniques for decision making" Himalaya publishing
   house
8. Billy E. Gillet - " Introduction to Operations Research" TMGH
9. R.Panneerselvan " Operations Research" PHI

Open Elective Course (OE001.c) :COST MANAGEMENT OF ENGINEERING PROJECTS

Teaching Scheme:	Examination Scheme:
Lectures: 3 Hours/ week	ESE: 70 marks
Credit- 3	ISE: 30 marks

	Course content	
Unit No.	**Details**	**Teaching Hours**
	Section-I	
1	**Cost and Cost Analysis OR** Cost:- Cost Elements - Pricing , Materials ,Labor , Engineering, Equipment, Parts and Tools; Economic Costs ; Cost Analysis:- Direct Cost, indirect Cost, Overhead, allowance, Contingency	8
2	**Cost Estimating:** Estimating Models; Parametric estimating- modular estimating, parametric model , Analogous estimating- ratio estimating, The Three-quarters rule, The Square root rule, Two-Thirds rule, Range estimating	7
3	**Progress & Cost Control:** Progress Measurement and Earned Values; Earned Value for Variable Budgets; Tracking Cost and Schedule Performance;	7
	Section-II	
4	**Cost Management**: Causes of Change, Feed Forward Techniques, Impact of schedule on cost, Lifecycle costs, Impact of project risk, integrated cost management programme.	8
5	**Value Management:** Concept of Value ,Dimensions and Measures of Value , Overview of Value Management, Definition" Scope, Key Principles of VM , Key Attributes of VM ,Value Management Terms ,Need for Value Management in Projects , The Value Management Approach ,Cross-functional Framework, Use of Functions, Structured Decision Process, The VM Process, Benefits of Value Management, Other VM requirements Relationship between Project Value and Risk, Value Management as an Aid to Risk Assessment	7
6	**Value Analysis:** Earned Value Management for assessing project performance, Earned Value Management, Earned Value Management Model, Fundamentals of Earned Value, EVM Terminology, Relevancy of Earned Value Management, Conducting an Earned Value Analysis, Performing an Earned Value Assessment, Managing a Portfolio of Projects with Earned Value Management, Important Issues in the Effective Use of Earned Value	7

	Management Integrating Cost and Value in Projects.	

Reference Books:
1. Project Estimating and Cost Management By Parivs F. Rad PhD, PMP
2. Project Cost Management guide from PMBOK 5th edition
3. Project Scheduling and Cost Control: Planning, Monitoring and Controlling the Baseline by James Taylor
4. Systems Life Cycle Costing: Economic Analysis, Estimation, and Management, John V. Farr, Draft Textbook, Version 1.0.
5. COST AND VALUE MANAGEMENT IN PROJECTS Ray R. Venkataraman and Jeffrey K. Pinto John Wiley & Sons, Inc Inc., Hoboken, New Jersey
6. American Association of Cost Engineers, "SKILLS AND KNOWLEDGE OF COST ENGINEERING", 1996
7. Cost Management of Capital Projects (Cost Engineering) by Kurt Heinze – International Edition, August 28, 1996

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)

Open Elective Course(OE001.d):NON CONVENTIONAL ENERGY

Teaching Scheme: **Examination Scheme:**
Lectures: 3 Hours/ week   ESE: 70 marks
Credit- 3   ISE: 30 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Energy Resources:** Energy, economy and social development, Indian scenario, conventional energy sources-electric, nuclear, hydroelectric, environmental aspects, renewable energy sources, comparison between conventional and non-conventional energy sources	5
2	**Energy Conservation and Efficiency:** Energy efficiency, conservation, energy audit, cogeneration, schemes to promote conservation and efficiency, new technologies, energy conservation opportunities, distributed energy systems	5
3	**Energy Storage:** Introduction, necessity, specifications of energy storage devices, methods of energy storage	3
4	**Solar Thermal Energy:** Introduction to solar radiation and energy, solar thermal energy collectors, solar thermal systems- water heater, distillation, power plant, cookers, kilns, air conditioning, greenhouse, furnace, dryer, industrial heating	5
	Section-II	
5	**Solar Photovoltaic System:** Solar cell fundamentals, characteristics, design consideration, classification, module and arrays, maximizing the output and load matching, balance of system, applications	5
6	**Wind Energy:** Fundamentals, wind energy estimation, turbines: types, construction and characteristics, modes of power generation, wind energy conversion system, wind diesel hybrid system, wind energy storage, environmental aspects, applications	5
7	**Biomass Energy:** Fundamentals, resources, conversion technologies, urban waste to energy conversion, gasification, ethanol, biogas	4

8	**Emerging Technologies:** Fuel cell, classification, comparisons, fuel for fuel cells, efficiency and VI characteristics, fuel cell power plant, hydrogen as energy carrier	4

Reference Books:

1. Non-Conventional Energy Resources, B H Khan, McGraw Hill Education, Third Edition
2. Renewable Energy Sauces and Emerging Technologies, D P Kothari, K C Singal, Rakesh Ranjan, PHI Learning Pvt. Ltd., Second Edition

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-III
Choice Based Credit System (CBCS)

Open Elective Course (OE001.e) PRODUCT DESIGN & DEVELOPMENT

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hours/ week	ESE: 70 marks
Credit- 3	ISE: 30 marks

Course content

Unit No.	Details	Teaching Hours
	Section-I	
1	**Introduction to product design and development :** Product life cycle, Product policy of an organization and profitable product selection, Product design, Product design steps and analysis	6
2	**Value Engineering and analysis:** Value Engineering concepts, Problem Identification, Functional analysis Functional analysis system steps, Case study on Value Engineering and analysis	6
3	**Quality Function Deployment** : Computer Aided Design, Robust Design, Design for X Ergonomics in product design	6
	Section-II	
4	**Ergonomics in product design:** Ergonomics/ Human factors, Posture and movement, Ergonomic design process, Performance support and design intervention, Design Ergonomics in India: scope for exploration	6
5	**DFMA (Design for Manufacturing and Assembly):** DFMA guidelines, Product Design for manual assembly, Design guidelines for different processes, Rapid prototyping – concepts and advantages, Prototyping processes	6
6	**Economic Decision:** Making/Cost Evaluation, Life cycle analysis Planning and Scheduling, Planning for manufacturing, Project planning, Risk and Opportunity Management, Metrics for Design and Development Program, Leadership Management and Control, Project start-up, Plans/schedules Design for Cost: Design for Six Sigma: Process, Invent, Innovate, Develop, Optimize and Verify	6

Reference Books:

1. Ulrich, Karl, and Steven Eppinger. Product Design and Development. McGraw-Hill,
2. Kemnneth Crow: Concurrent Engg./Integrated Product Development, DRM
3. Staurt Pugh: Tool Design -Integrated Methods for Successful Product Engineering, Addison Wesley Publishing, New York, NY

EC211 Dissertation Phase I : Synopsis Submission Seminar

Credits: 3

Examination Assessment Scheme:
ICA: 100 Marks

- The student is expected to carry out intensive literature survey for a period of about two months in the field of interest and to select a topic for his/her dissertation in consultation with the faculty advisor assigned.

- The student shall then submit a report and deliver a seminar on the problem chosen by him/her to the panel of three departmental PG recognized faculty members.

- It is expected that a student justifies the gravity and also the relevance of the problem through his/her seminar. This shall be for the approval of synopsis.

- The assessment of Synopsis Submission Seminar shall be done by aforesaid panel of three departmental PG recognized faculty members.

EC212 Dissertation Phase II : ICA

Examination Assessment Scheme:

Credits: 3   **ICA: 100 Marks**

- Student shall submit a report to the faculty advisor, on the basis of work carried out in accordance with instructions given by faculty advisor, throughout the semester. Dissertation Phase II evaluation consists of term-work evaluation (ISE) based on the efforts put in by the student to carry out his/her work & the results obtained.

- The faculty advisor shall complete the assessment of the report and accordingly allocate the marks to the student out of maximum 100 marks.

EC213 Dissertation Phase II : Progress Seminar

Examination Assessment Scheme:

Credits: 3   **ICA: 100 Marks**

- Progress seminar shall be delivered capturing details of the work done by the student for dissertation. Student shall deliver seminar using modern presentation tools.

- A hard copy of report shall be submitted to the faculty advisor before delivering the seminar. A PDF copy of the report must be submitted to the faculty advisor along with other details if any.

- End Semester Evaluation (ESE) shall consist of presentation of progress seminar on the report submitted by the student, followed by demonstration before a panel of three departmental PG recognized faculty members.

EC221 Dissertation Phase III : Progress Seminar

Examination Assessment Scheme:

Credits: 3   **ICA: 100 Marks**

- For all activities related to Phase III, student must interact regularly every week with the faculty advisor. The student who has cleared his/her Phase II evaluation, shall submit a report and present the status of work carried out on the dissertation after 8-10 weeks of Phase II ESE to three departmental PG recognized faculty members.

- Progress seminar shall be delivered capturing details of the work done by student for dissertation. Student shall deliver seminar using modern presentation tools.

- A hard copy of report shall be submitted to the faculty advisor before delivering the seminar. A PDF copy of the report must be submitted to the faculty advisor along with other details if any. The evaluation will be done by the aforesaid panel of three departmental PG recognized faculty members based on the requirements of completion of dissertation work for the dissertation Phase III.

EC222 Dissertation Phase IV

Examination Assessment Scheme:
Credits: 6   **ICA: 200 Marks**

- After completing the dissertation work to the satisfaction of faculty advisor, the student shall submit the dissertation report to the University in the prescribed format.

- The final approved dissertation shall be submitted in black bound hard copy along with soft copy on CD/DVD. The evaluation of dissertation is to be carried out by the faculty advisor as ICA. This evaluation shall be on the basis of the requirements of completion of dissertation work.

- The faculty advisor shall submit mark list of term work marks, along with the submission of dissertation to university as mentioned in assessment scheme.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Tech. (Electronics & Telecommunication Engg.) Semester-IV
Choice Based Credit System (CBCS)
EC223 Final Submission of the Dissertation and Viva –Voce

Examination Assessment Scheme:

Credits: 6
ESE: 200 Marks

- Open defense of the student on his/her dissertation shall be arranged by the university.

- This defense shall be in front of the panel of examiners as appointed by university authority. The evaluation will be done by panel of examiners as appointed by university authority.