V. E. S. Institute of Technology

T.E.

Instrumentation Engineering

(Semester – VI)

Autonomy Syllabus

Effective A. Y. 2023-24

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract. Tut.	Theory	Pract.	Tut.	Total
ISC601	Industrial Process Control	3	--	3	--		3
ISC602	Digital Signal Processing	3	--	3			3
ISC603	Industrial Data Communication	3	--	3	--		3
ISDOC 601X	Department Level Elective – 2	3	--	3	--		3
ISL601	Industrial Process Control Lab	--	2	--	1		1
ISL602	Digital Signal Processing Lab	--	2	--	1		1
ISL603	Python Programming Lab	--	2+2#	--	2		2
ISM601	Mini Project–2 B	--	4$	--	2		2
Total		**12**	**12**	**12**	**06**		**18**

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISC601	Industrial Process Control	20	20	60	2	-	-	100
ISC602	Digital Signal Processing	20	20	60	2	--	--	100
ISC603	Industrial Data Communication	20	20	60	2	--	--	100
ISDOC601X	Department Level Elective – 2	20	20	60	2	--	--	100
ISL601	Industrial Process Control Lab	--	--	--	--	25	25	50
ISL602	Digital Signal Processing Lab	--	--	--	--	25	25	50
ISL603	Python Programming Lab	--	--	--	--	25	25	50
ISM601	MiniProject–2 B					25	25	50
Total		80	80	240	8	100	100	600

$ indicates workload of Learner (Not Faculty), for Mini Project.

out of 4 hours, 2 hours theory shall be taught to entire class and 2 hours practical in batches

Department Level Elective – 2 (Semester-VI)

ISDOC6011	Instrumentation for Agriculture	**No Lab work**
ISDOC6012	Optimization Techniques	
ISDOC6013	Database Management Systems	
ISDOC6014	Bio- Sensors and Signal Processing	

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISC601	Industrial Process Control	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISC601	Industrial Process Control	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISC601	Industrial Process Control	3

Course Objectives:	
1	To impart the knowledge of different industrial unit operations.
2	To make the students capable to design and develop instrumentation and control schemes for industrial processes.
3	To give them an overview of various process industries, hazardous areas and their classification.

Course Outcomes:	
The students will be able to	
1.	Explain working and control of heat exchanger and evaporator
2.	Explain working and control boiler and furnace
3.	Elaborate working and control of distillation and reactor
4.	Explain working and control of dryer and crystallizer
5.	Describe the processes of batch and continuous process industries and instrumentation involved in them.
6.	Classify hazardous areas in the industry.

Module	**Detailed Content**	**No. of Hours**
1	**Heat transfer unit operations-I:** Introduction to unit operations and processes, concept of heat transfers and energy balance, heat transfer coefficient. **Heat exchanger control:** classification as per fluid flow arrangement and construction, feedback, feed-forward, bypass control schemes, fouling in heat exchangers. **Evaporator control:** Evaporator terminologies, Types of Evaporators, control systems for Evaporator – feedback, cascade, feed forward and selective control.	06
2	**Heat transfer unit operations-II:** **Boiler control:** Types, working and operation of boilers, Terms related- Shrink and swell effect and excess oxygen, boiler efficiency, Boiler controls- Drum level control- Single, two and three elements, and Combustion Control- Type 1, 2, 3 and 4, steam temperature control, boiler pressure control, furnace draft control.	09

	Furnace control: Start- up heaters, fired reboilers, process and safety controls.	
3	**Heat and mass transfer unit operations-I:** **Distillation column:** Basic principle, Distillation equipment and its accessories. Batch and continuous distillation, Binary product distillation, multi-product distillation, Vacuum distillation. **Distillation column control strategies**- Top and bottom product composition controls-inferential and direct, Pressure controls, Vapours recompression, Feed controls- Column feed controls, economizer. **Reactor control:** Reactor characteristics, runaway reaction, various schemes of temperature control of reactors.	09
4	**Heat and mass transfer unit operations-II:** **Dryer control:** Process of drying, types and control strategies of dryer- Tray, , fluidized bed, rotary and spray dryer. **Crystallizers control:** Process of crystallization, Super-saturation methods, types of crystallizer and control strategies- evaporating crystallizer, cooling crystallizers, vacuum crystallizers.	06
5	**Continuous and Batch Process Industries:** **Refinery Industry:** Process flow diagram, separation, conversion methods, sensors and control schemes. **Iron and steel Industry**: Process flow diagram, Sensors and Control schemes. **Pharmaceutical industries**- Penicillin-G production, sensors and control schemes.	05
6	**Safety in Instrumentation control systems:** Area and material classification as per IEC and NEC standard, techniques used to reduce explosion hazards, intrinsic safety, and installation of intrinsically safe systems.	04
	Total	**39**

Text Books:	
1.	W. L. McCabe and Julian Smith, Unit operation and chemical engineering‖, Tata McGraw Hill, Sixth edition, 2001.
2.	Bela G. Liptak, Instrument engineer's handbook-Process control, Chilton book company, third edition,1995.
3.	Bela G. Liptak, Instrumentation in the processing industries, Chilton book company-first edition, 1973.
4.	W. L. McCabe and Julian Smith, Unit operation and chemical engineering‖, Tata McGraw Hill, Sixth edition, 2001.

References:	
1	Douglas M. Considine, Process industrial instruments and controls handbook‖, McGraw Hill- 4thedition,1993.
2	George T. Austin, Shreve 's chemical process industries‖, Mc-GrawHill- fifth edition,1984.
3	George Stephenopoulos, Chemical process control, PHI-1999.
4	David Lindsey, Power Plant control and instrumentation – control of boilers HRSG, Institution of Engineering and Technology,

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.
Attendance+Tutorials/Assignment/Viva/Mini Project based on the entire syllabus.

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISC602	Digital Signal Processing	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISC602	Digital Signal Processing	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISC602	Digital Signal Processing	3

Course Objectives:	
1	To introduce the basic concept of discrete time signal processing and acquire knowledge about DSP and its fundamentals.
2	To familiarize with Fourier transform algorithms and convolution of DT sequences.
3	Ability to design IIR digital filters and realization of its structures using different forms.
4	To design FIR filters using different methods.

Course Outcomes:	
The students will be able to	
1.	Understand the basic concepts of discrete-time signals and systems, sampling, aliasing, and DSP.
2.	Analyse LTI systems in time-domain and realize it using different structures.
3.	Analyse LTI systems in frequency domain.
4.	Demonstrate an ability to apply Discrete Fourier Transform, Fast Fourier transform.
5.	Design FIR filter by different techniques.
6.	Describe how IIR filters are designed and implemented by different methods

Module	**Detailed Content**	**No. of Hours**
1.	**Introduction to Signals and Systems:** Discrete-time signals and systems: classification of signals, sampling process/theorem, aliasing effect and reconstruction, classification of systems, input-output description of systems, block-diagram representation of discrete-time systems. Basic elements of Digital Signal Processing (DSP), analog to digital conversion (ADC), comparison between DSP and Analog Signal Processing (ASP) with applications of DSP.	06
2.	**Analysis of discrete-time systems** Linear convolution, causality and stability of discrete time systems, autocorrelation, cross-correlation, z-transform and its properties, solving difference equations and analysis of discrete-time systems in z-domain, transfer function, pole-zero plot. Implementation of discrete-time systems: Structures for the realization, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) structures.	07

3.	**Frequency analysis of discrete-time signals** Frequency response of LTI systems, ideal frequency selective filters, magnitude and phase response, Discrete-time Fourier Series, properties of DFS, The Discrete Time Fourier Transform (DTFT), symmetry properties and theorems of DTFT. Energy density spectrum and power density spectrum.	06
4.	**Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)** Discrete Fourier transform (DFT), properties of DFT, symmetry properties, circular convolution, linear filtering methods based on DFT, Frequency analysis of signals using DFT, Efficient computation of DFT, Fast Fourier Transform (FFT) algorithms: radix-2 decimation-in-time (DIT) and decimation-infrequency (DIF)FFT algorithms.	07
5.	**Design of FIR filters** Introduction to FIR filters, linear phase filters, symmetric and anti-symmetric filters, FIR design by Fourier approximation, window method, frequency sampling method, comparison between FIR and IIR filters.	06
6.	**Design of digital IIR filters from analog filters** Introduction to analog IIR filters, Butterworth approximation, Chebyshev approximation. Design of digital IIR filter: approximation derivative method, impulse invariance method, bilinear transformation, Frequency transformations in analog and digital domain. **Recent trends in DSP system design**: - Introduction, Architecture of TMS 320C54X, CPU, Arithmetic logic unit, Multiplier/Adder unit, Engineering applications of DSP processors	07
	Total	**39**

Text Books:

1.	V. Oppenheim and R. W. Schafer, Discrete Time Signal Processing, Pearson Education, 2000.
2.	J. G. Proakis and D. J. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, PHI, 4th Edition, 2007.
3.	NagoorKani, “Digital Signal Processing”, McGraw Hill Publications, 2017.
4.	V. Oppenheim and R. W. Schafer, Discrete Time Signal Processing, Pearson Education, 2000.

References:	
1	B. Porat, A Course in Digital Signal Processing, J. Wiley and Sons, 1996.
2	J. R. Johnson, Introduction to Digital Signal Processing, PHI, 1989.
3	Rabiner, Gold, Theory and Applications of Digital Signal Processing, TMH, 1996.
4	S. K. Mitra, Digital Signal Processing-A Computer Based Approach, MGH, 1997.
5	E. C. Ifeachor and B. W. Jervis, Digital Signal Processing-A practical Approach, Addison-Wesley publication, 2002.

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.
Attendance+Tutorials/Assignment/Viva/Mini Project based on the entire syllabus.

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISC603	Industrial Data Communication	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISC603	Industrial Data Communication	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISC603	Industrial Data Communication	3

Course Objectives:	
1	To expose students to the basics of communication
2	To create awareness about the OSI reference model.
3	To acquaint the students with the different types of networks at various levels such as sensor level, device network and control network.
4	To provide sufficient knowledge about the HART.
5	To impart the fundamentals of foundation field bus.

Course Outcomes:	
The students will be able to	
1.	Explain the importance of modulation in communication.
2.	Examine the importance of OSI, TCP/IP model and various networking components.
3.	Compare the different types of networks at various levels of field communication.
4.	Use HART for communication
5.	Establish Foundation fieldbus communication.
6.	Investigate the various wireless devices.

Module	**Detailed Content**	**No. of Hours**
1	**Introduction to Communication System:** Elements of communication system, Noise in communication Systems. Amplitude Modulation: Introduction, Time and frequency domain analysis, Frequency Modulation, Phase Modulation, Effect of noise in FM. Digital Modulation, PAM, PPM, PWM, FSK, QPSK.	08
2	**Introduction to Networks:** OSI reference model**,** TCP/IP model, Transmission media, UTP-STP cable, coaxial cable, N/W components: Repeaters, bridge, hub, switch, router, gateways. **Open Control N/W: RS232, RS422, EIA485** Modbus Structure, Implementation, GPIB. Proprietary Control N/W:Modbus Plus	06

3	**Networks at different levels:** Sensor level network: AS-i, CAN, Device net, Interbus and LON Device networks: Foundation Fieldbus H1-HART Profibus-PA Control Network: BAC net, control-net, FF-HSE, Profibus-DP, Ethernet, TCP/IP	08
4	**HART:** Architecture, Physical, Data Link, Application, Communication Technique, Normal and burst mode of communication, Troubleshooting, Benefits of HART	06
5	**Foundation Fieldbus:** Fieldbus requirement, features, advantages, fieldbus components, types, architecture– physical, data link, application layer, system and network management, wiring, segment functionality checking, installation in safe and hazardous area and troubleshooting, function block application process. **OPC Architecture**	06
6	**Wireless Technologies:** Satellite systems, Wireless LANs (WLANs), WiFi, VPAN, Zigbee, bluetooth GPRS and – their comparison, limitations and characteristics, Introduction to IOT and IIOT, RFID	05
	Total	**39**

Text Books:	
1	Deon Reynders, Steve Mackay, Edwin Wright, Practical Industrial Data Communications, 1st edition ELSEVEIR,2005.
2	Lawrence M Thompson, Industrial Data Communication, 2nd edition, 1997.

References:	
1	Daniel T Miklovic, Real Time Control Networks, ISA 1993.
2	Bela G Liptak, Process Software and Digital Networks,3rd edition2002.
3	Andrew S. Tanenbaum, Computer Networks, 4th edition, PHI/Pearson Education, 2002.

4	Behrouz A. Forouzan, Data Communications and Networking, 2nd update edition, Tata McGraw Hill Publishing Company, New Delhi,2000.
5	Douglas Corner, Computer Networks and Internets, 2nd edition, Pearson Education Asia,5th Indian reprint, 2001.

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.
Attendance+Tutorials/Assignment/Viva/Mini Project based on the entire syllabus.

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC 6011	Instrumentation for Agriculture	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISDOC6011	Instrumentation for Agriculture	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISDOC 6011	Instrumentation for Agriculture	3

Course Objectives:	
1	To impart background information required for studying application of instrumentation in agriculture.

Course Outcomes:	
The students will be able to	
1.	Illustrate the necessity of instrumentation in agriculture.
2.	Demonstrate soil properties and sensors used to measure the same.
3.	Develop an automation scheme for irrigation.
4.	Develop an automation scheme for greenhouse.
5.	Apply instrumentation to agricultural equipment.
6.	Demonstrate instrumentation in continuous and batch process in agriculture-based products.

Module	Detailed Content	No. of Hours
1	**Introduction:** Necessity of instrumentation and control for agriculture sensor requirement, remote sensing, biosensors in agriculture, standards for food quality.	3
2	**Soil Properties:** Engineering properties of soil pH, conductivity, resistivity, temperature, soil moisture and salinity. **Sensors:** Ion concentration measurement, method of soil analysis, Instrumentation for environmental conditioning of seed germination and growth, introduction to sonic anemometers, hygrometers/ soil moisture measurement (resistance-based method, voltage-based method, thermal based method), fine wire thermocouples, open & close path gas analysers.	7
3	**Instrumentation in Irrigation:** irrigation methods: overhead, Centre pivot, lateral move, micro irrigation systems &it's performance, comparison of different irrigation systems, irrigation scheduling, irrigation efficiencies, auto drip & sprinkler irrigation systems. Water distribution & management control, irrigation canal management systems, design considerations in irrigation channels, upstream & downstream control concept.	7
	Greenhouse Parameters & Instrumentation: Basic concept of Greenhouse, merits & demerits, ventilation, cooling & heating, wind speed, temperature &	

4	humidity, soil moisture, rain gauge, carbon dioxide enrichment measurement & control, Leaf area length Evapo-transpiration, temperature, wetness & respiration measurement & data logging, electromagnetic radiations photosynthesis.	7
5	**Applications in Agricultural Equipment:** Automation in earth moving equipment& farm equipment, implementation of hydraulic, pneumatic & electronics control circuits in harvesters cotton pickers, tractor etc. classification of pumps: pump characteristics, pump selection & installation.	7
6	**Instrumentation in Continuous & Batch process:** Flow diagram, sensors & instrumentation set up of: Sugar plant, Fermenter (batch process), Dairy industry, Juice extraction and Oil extraction.	8
	Total	**39**

Text Books:

1	D. Patranabis, Principles of Industrial instrumentation, TMH (2010), ISBN-13: 9780070699717
2	Michael. A.M, Irrigation: Theory and Practice, Vikas Publishing House Pvt Ltd, Second edition (2008), ISBN-13: 978-8125918677
3	Curtis D. Johnson, Process control and instrumentation technology, 8th Edition, 2015, Pearson, ISBN: 9789332549456, 9332549451
4	Akalank Kumar Jain, Vidhi Jain Food Safety and Standards Act, Rules & Regulations, Akalank Publications; 13th Edition (2015), ISBN-13: 9788176393584
5	Rosana G. Moreira, Automatic Control for Food Processing Systems (Food Engineering Series), Springer; 2001 edition (28 February 2001), ISBN-13: 9780834217812
6	Wills B.A., Mineral Processing Technology, 4th Ed., Pergamon Press.

References:

1	Bela G. Liptak, Instrument Engineers' Handbook, Process Control and Optimization, CRC Press; 4 edition (29 September 2005), ISBN-13: 978-0849310812.
2	Robert H. Brown, CRC Handbook of Engineering in Agriculture, Volume II: Volume 1 (C R C SERIES IN AGRICULTURE), CRC Press; 1 edition (30 June 1988), ISBN13: 978-0849338625.

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.
Attendance+Tutorials/Assignment/Viva/Mini Project based on the entire syllabus.

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC6012	Optimization Techniques	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISDOC 6012	Optimization Techniques	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISDOC6012	Optimization Techniques	3

Course Objectives:	
1	Students should understand the process of optimization, formulation of practical engineering problems into optimization problems and applying necessary and sufficient conditions of optimality to check the feasibility of the problems.
2	Students should study the concepts of linear as well as nonlinear programming methods.
3	Based on the nature of the problem i.e. linear, nonlinear, one dimensional, multidimensional, students can use appropriate methods to solve it.
4	Students will understand how to apply numerical unconstrained methods to solve constrained optimization problems.
5	Students should understand the process of optimization, formulation of practical engineering problems into optimization problems and applying necessary and sufficient conditions of optimality to check the feasibility of the problem.

Course Outcomes:	
The students will be able to	
1.	Translate descriptive statements of the design engineering problems into a mathematical statement of optimization.
2.	Write optimality conditions for unconstrained and constrained problems and use Lagrange multiplier and KKT necessary conditions for solving problems.
3.	Translating a linear programming problem (LPP) into standard form and then use simplex or two-phase simplex method.
4.	Use an alternate form of two-phase simplex method called Big-M method to also write dual problems for the given LP Problem for solving it.
5.	Explain gradient-based search and direct search methods for design optimization problems.
6.	Use the numerical methods for unconstrained optimization.

Module	**Detailed Content**	**No. of Hours**
1	**Introduction to Optimization:** Definition and meaning of optimization, need of optimization, optimization problem formulation – statement of an optimization problem, terminology- design vector, objective function, objective function surface, design constraints, constraint surface, Iteration, convergence, classification of optimization problem, conventional versus -optimum design process, - optimal control problem, problem formulation process, engineering applications of optimization.	06

2	**Classical Optimization Techniques:** Fundamental concepts- local and global minima, local and global maxima, quadratic form, necessary and sufficient condition of single and multivariable optimization with no constraints, multivariable optimization with equality and inequality constraints (Kuhn-Tucker condition), Lagrange Theorem	05
3	**Linear Programming – Simplex Method** Definition of linear programming problem (LPP), standard form of LPP, terminology, basic concepts, Simplex Algorithm and flowchart, simplex method, two-phase simplex method	08
4	**Linear Programming – Revised Simplex Method** Duality in linear programming – standard primal LP problem, dual LP problem, Treatment of equality constraints, determination of the primal solution from the dual solution, dual variables as Lagrange multipliers, KKT conditions for the LP problem,	09
5	**Numerical Methods for Unconstrained Optimum Design – Direct Method** General algorithm for unconstrained minimization methods, rate of convergence, unimodal and multimodal function, reduction of a single variable, one dimensional minimization methods- Equal Interval method, Golden section search method.	06
6	**Numerical Methods for Unconstrained Optimum Design – Indirect Method** Gradient of a function, Steepest Descent, Conjugate gradient (Fletcher- Reeves), Step size determination – polynomial interpolation, properties of gradient vector	05
	Total	**39**

Text Books:

1	Jasbir S. Arora, Introduction to Optimum Design, 3rd Edition, Academic Press – 2012.
2	Ashok D. Belegundu, Optimization concepts and applications in Engineering, Pearson Education, 2002

References:	
1	S. S. Rao, Optimization, 3rd Enlarged Edition, New Age International (P) Ltd., Publishers, New Delhi, 2010.
2	T. E. Edger and D. M. Himmeblaue, Optimization of Chemical Processes, McGraw Hill International Editions, 1989.
3	William L. Luyben, Process Modeling, Simulation, and Control For Chemical Engineers, McGraw- Hill Publishing Company,1990.
4	Kalyanmoy Deb, “Optimization for Engineering Design”, Prentice Hall of India (P) Ltd., New Delhi, 1998.

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.
Attendance+Tutorials/Assignment/Viva/Mini Project based on the entire syllabus.

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC 6013	Database Management System	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Ex Dur (Hrs)			
		Mid Test (MT)	CA *					
ISDOC 6013	Database Management System	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISDOC 6013	Database Management System	3

Course Objectives:	
1	Learn and practice data modelling using the entity-relationship and developing database designs.
2	Understand the use of Structured Query Language (SQL) and learn SQL syntax.
3	Apply normalization techniques to normalize the database

Course Outcomes:	
The students will be able to:	
1.	To describe data models and schemas in DBMS.
2.	Explain the features of database management systems and Relational databases.
3.	Use SQL- the standard language of relational databases.
4.	Identify the functional dependencies and design a database.
5.	Describe the concept of Transactions Management and Concurrency.
6.	Explain the concept of Query Processing and Optimization.

Module	**Detailed Content**	**No. of Hours**
1	**Introduction Database Concepts:** Introduction, Characteristics of databases, File system V/s Database system, Users of Database system, Concerns when using an enterprise database, Data Independence, DBMS system architecture, Database Administrator **Entity–Relationship Data Model:** Introduction, Benefits of Data Modelling, Types of Models, Phases of Database Modelling, The Entity-Relationship (ER) Model, Generalization, Specialization and Aggregation, Extended Entity Relationship (EER) Model.	06
2	**Relational Model and Algebra:** Introduction, Mapping the ER and EER Model to the Relational Model, Data Manipulation, Data Integrity, Advantages of the Relational Model, Relational Algebra, Relational Algebra Queries, Relational Calculus.	06

3	**Structured Query Language (SQL):** Overview of SQL, Data Definition Commands, set operations, aggregate function, null values, Data Manipulation commands, Data Control commands, Views in SQL, Nested and complex queries.	06
4	**Integrity and Security in Database:** Domain Constraints, Referential integrity, Assertions, Trigger, Security, and authorization in SQL **Relational–Database Design:** Design guidelines for relational scheme, Function dependencies, Normal Forms- 1NF, 2 NF, 3NF, BCNF and 4NF	08
5	**Transactions Management and Concurrency:** Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Implementation of isolation, Concurrency Control: Lock- based, Timestamp-based, Validation-based protocols, Deadlock handling, Recovery System: Failure Classification, Storage structure, Recovery & atomicity, Log based recovery, Shadow paging.	08
6	**Query Processing and Optimization:** Overview, Issues in Query Optimization, Steps in Query Processing, System Catalog or Metadata, Query Parsing, Query Optimization, Access Paths, Query Code Generation, Query Execution, Algorithms for Computing Selection and Projection, Algorithms for Computing a Join, Computing Aggregation Functions, Cost Based Query Optimization.	05
	Total	**39**

Text Books:

1	G. K. Gupta, Database Management Systems, McGraw – Hill.
2	Korth, Slberchatz,Sudarshan, Database System Concepts, 6th Edition, McGraw – Hill
3	Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, PEARSON Education.
4	Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning, 5th Edition.
5	G. K. Gupta, Database Management Systems, McGraw – Hill.

References:	
1	Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press
2	Mark L. Gillenson, Paulraj Ponniah, Introduction to Database Management,Wiley
3	Sharaman Shah, Oracle for Professional, SPD.
4	Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems,TMH
5	DebabrataSahoo, Database Management Systems, Tata McGraw Hill, Schaum‟s Outline

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.
Attendance+Tutorials/Assignment/Viva/Mini Project based on the entire syllabus.

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year
B.E Instrumentation Engineering
(With Effect from 2023-2024)
Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDLO 6023	Bio- Sensors and Signal Processing	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End SemExa m	Ex Dur(Hrs)			
		Mid Test(MT)	CA *					
ISDLO6023	Bio-Sensors and Signal Processing	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISDLO 6023	Bio-Sensors and Signal Processing	3

Course Objectives:	
1	To provide basic knowledge of various bio-sensors and their uses in biomedical applications.
2	To provide understanding of principle and operation of different types of bio-sensors like potentiometric, optical and amperiometric sensors.
3	To introduce the students to basic signal processing methods used in bio- signal measurement and analysis

Course Outcomes:	
The students will be able to	
1.	To describe the basic concept behind bioelectric phenomena.
2.	To classify the different types of biosensors and describe their characteristics.
3.	To explain different biosensors and transducers used for physical measurands.
4.	To explain the various types of chemical biosensors and transducers and their significance in chemical measurands.
5.	To explain about the various basic signal processing techniques used in bio-signal acquisition and analysis.
6.	To apply the appropriate biosensor for different applications.

Module	Detailed Content	No. of Hours
1	**Bioelectricity and Bioelectric Phenomena** Sensors/receptors in the human body, basic organization of nervous system, neural mechanism and propagation of action potential in nerve/muscle cells, Electrode theory, electrode-tissue interface (metal-electrolyte interface), electrode-skin interface, electrode impedance.	05
2	**Introduction to biological sensors** Sensor architecture and Classification of biosensors: Medically significant measurands, functional specifications of medical sensors; Biosensor characteristics: linearity, repeatability, hysteresis, drift.	04

3	**Physical Biosensors and Transducers** Biosensors for physical measurands: strain, force, pressure, acceleration, flow, volume, temperature and bio-potentials. Various types of transducers; principles and applications- Resistive, Capacitive, Inductive, Photoelectric, piezoelectric and mechanical based transducers in biosensors. Principle of fiber optic cable, fiber optic sensors, Photo acoustic sensors in biomedical field.	09
4	**Chemical Biosensors and Transducers:** Bio-sensors for measurement of chemicals: Potentiometric sensors, ion selective electrodes, Amperometric sensors, Clark Electrode biosensors, Catalytic biosensors, Immuno-sensors. Chemiluminescence-based biosensors, pH electrode, pO2 and pCO2 electrodes, Liquid and solid ion exchange membrane electrode, Enzyme electrode.	10
5	**Bio-signal Acquisition and Processing** Measuring ultra- small signals, noise. Electrical signals produced by cells, Various types of signal processing techniques used for bio-signals, such as Fast Fourier Transform (FFT), Wavelet transform (WT).	05
6	**Applications of Biosensors** Biosensors in clinical chemistry, medicine and healthcare, biosensors for veterinary, agriculture and food, Low cost- biosensor for industrial processes for on line monitoring; biosensors for environmental monitoring.	06
	Total	**39**

Text Books:

1	Richard S.C, Cobbold, Transducers for Biomedical Measurements: Principles and Applications, John Wiley& Sons, 1992.
2	A.P.F. Turner, I. Karube & G. S. Wilson, Biosensors: Fundamentals & Applications, Oxford University Press, Oxford, 1987.

3	Rangan C.S., Sarma G.R., and Mani V.S.V., Instrumentation devices and system, Tata McGraw Hill Publishing Company limited, New Delhi, 2006.
4	John G.Webster, Medical Instrumentation: Application and Design, John Willey and sons, 1999.
5	Jacob Kline, Handbook of Biomedical Engineering, Academic press Inc., Sandiego, 1988

References:

1	Richard Aston: Principles of Biomedical Instrumentation and Measurement, Merrill Publishing Co., Columbus, 1990.
2	Ernest O. Doeblin, Measurement Systems, Application and Design, Tata McGraw-Hill, 1985.
3	R. S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill.

Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

Term work:

Total 25 Marks Term work will be based on overall performance in the subject.

Attendance+Tutorials/Assignment/Viva/Mini Project based on entire syllabus.

End Semester Theory Examination:

1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five need to be solved.

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL601	Industrial Process Control Lab	-	2	-	1	-	1

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Ex Dur (Hrs)			
		Mid Test (MT)	CA *					
ISL601	Industrial Process Control Lab	—	-	-	–	25	25	50

Lab Objectives:	
1	To impart the knowledge of different industrial unit operations.
2	To make them capable to design and develop instrumentation and control schemes for industrial processes.

3	To give them exposure to work in the process industry.
4	To explain students about hazardous area and safety design system

Lab Outcomes:	
The students will be able to	
1.	Explain working and control of heat transfer unit operations- heat exchanger and evaporator
2.	Explain working and control of heat transfer unit operations- boiler and furnace
3.	Explain working and control of heat and mass transfer unit operations- distillation and reactor
4.	Explain working and control of heat and mass transfer unit operations- dryer and crystallizer
5.	Describe the processes of batch and continuous process industries and instrumentation involved in them.
6.	Classify hazardous areas in the industry.

List of Laboratory Experiments/Assignments:

Sr. No.	**Detailed Content**
1	Demonstrate the operation and control scheme of Heat exchanger
2	Learn working of various Unit Operations (Boilers/furnace / Distillation column etc.) using online learning resources.
3	Demonstrate the reactor control system.
4	Demonstrate the operation & control scheme of dyer/crystallizer.
5	Prepare a report on any one industry.
6	Develop some charts on hazardous area classification.
7	Assignment/Exercise on heat transfer unit operations- heat exchanger, evaporator

8	Assignment/Exercise on heat transfer unit operations-boiler, furnace
9	Assignment/Exercise on heat and mass transfer unit operations-Distillation, reactor
10	Assignment/Exercise on heat and mass transfer unit operations-Crystallization, dryer
11	Assignment/Exercise on continuous or batch process industries
12	Assignment/Exercise on hazardous area classification

Term Work:

Term work should consist of 10 experiments

1. Journal must include at least 2 assignments.
2. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work
3. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

Continuous assessment exam

Based on the subject and related lab of **ISC601**

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL602	Digital Signal Processing Lab	-	2	-	1	-	1

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Ex Dur (Hrs)			
		Mid Test (MT)	CA *					
ISL602	Digital Signal Processing Lab	–-	–	–	–	25	25	50

Lab Objectives:	
1	Study simulation software platform for digital signal processing and Plot different type of signals.
2	To understand the concept of linear, circular convolution, correlation and simulate it by computer software.

3	To understand Fourier transform and its algorithms such as FFT and IFFT and simulate it.
4	To design and implement filters both FIR and IIR using computer simulation.

Lab Outcomes:	
The students will be able to	
1.	Verify sampling theorem using simulation software.
2.	Demonstrate convolution and correlation concepts using simulation software.
3.	Analyse frequency response of LTI systems using DTFT. Perform Discrete Fourier Transform of signals.
4.	Design and implement FIR and IIR filters using computer simulation software platform.
5.	Design and implement IIR filters using computer simulation software platform.
6.	Design and implement IIR filters using computer simulation software platform.

List of Laboratory Experiments/Assignments:	
Sr. No.	**Detailed Content**
1.	Write a Program to generate the basic signals and verify sampling theorem.
2.	Write a Program to implement the basic operations on the given signals
3.	Write a Program to implement Linear Convolution of the two given sequences.
4.	Write a Program to obtain the auto-correlation and Cross-correlations of the given sequences.
5.	Write a Program to obtain the transfer function and plot is pole-zero plot
6.	Write a Program to find the DTFT of the given sequence and plot its magnitude and phase plot
7.	Write a Program to find the DFT of the given sequences. Plot its magnitude and phase plot. Also find its IDFT to obtain the original sequence.

8.	Write a Program to obtain the circular convolution of the two given sequences.
9.	Write a Program to obtain the linear convolution using circular convolution of two given sequences.
10.	Write a Program to obtain the DFT of the given sequences using DIT-FFT algorithm and plot its magnitude and phase spectrum.
11.	Write a Program to design low-pass and high-pass FIR filters using window functions.
12.	Write a Program to design a digital IIR low-pass filter using Butterworth/Chebyshev approximations.

Term Work:

Term work should consist of 10 experiments

1. Journal must include at least 2 assignments.
2. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work
3. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

Continuous assessment exam

Based on the subject and related lab of **ISC60**2

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL603	Python Programming Lab	-	2	-	1	-	1

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Ex Dur (Hrs)			
		Mid Test (MT)	CA *					
ISL603	Python Programming Lab					25	25	50

Lab Objectives: To know the basics of algorithmic problem solving	
1	To read and write simple Python programs.
2	To develop Python programs with conditionals and loops.
3	To define Python functions and call them.
4	To use Python data structures - lists, tuples, dictionaries.

Lab Outcomes:	
Upon completion of the course, students will be able to	
1.	Read, write, execute by hand simple Python programs.
2.	Represent compound data using Python lists, tuples, dictionaries.
3.	To develop Python programs with conditionals and loops.
4.	To learn simple Python programs for file handling and I/O operations.
5.	Implement simple python programs for Machine learning applications
6.	To develop Graphical User Interface for different Python programs

Module	**Contents**	**Hrs.**
1	**Introduction: Python Basics:** Why Python for scientific computing? Python versions: IDE, features of IDE, commonly used IDE, Setting Working Directory, Creating and saving a script file, File execution, clearing console, removing variables from environment, clearing environment, Commenting script files, Variable creation, Arithmetic and logical operators, Data types and associated operations, Mathematical functions.	**04**
2	**Advance Data Types, Control Flow, and Functions:** Numbers, Sequences, passing arguments to functions, Statements and Expressions, Operators and Math's, Conditionals, Loops, Strings, List, Tuples, Set Operation, Dictionary (Dict), Range, Date and Times. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.	**04**

3	**Numerical Python (Numpy) and Visualising Data:** Array operations, Numpy Side Effects, 2D Numpy Arrays, Numpy Basic Statistics, Universal Functions, Examples using linear algebra operations. Matplotlib and Pylab, Introduction, Simple plots, Line API, Legend API, Figures, Subplots, Axes and Ticks, Histograms, Visualising matrix data.	**06**
4	**Python File Handling, Python File I/O and Regular Expression:** Python File Handling: Create, Open, Append, Read, Write functions Python File I/O: Open a file, Read or write (perform operation), File Methods, Close the file. Regular Expression: Basis, findall, search, split, sub	**04**
5	**Machine Learning in Python(scikit-learn):** Classification, Regression, Clustering, Dimensionality Reduction, Ensemble methods, Feature extraction, Feature selection, Supervised Models	**04**
6	**Graphical User Interface (GUI) Development using Python:** Introduction to Tkinter, Tkinter Programming, Creating a GUI application, Tkinter Widgets: Operator & Description, Standard attributes, Geometry Management.	**04**

Text Books:

1)	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O 'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2)	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References:

1)	John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013
2)	Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3)	Timothy A. Budd, Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd, 2015.
4)	Kenneth A. Lambert, Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5)	Raúl Garreta , Guillermo Moncecchi, Learning scikit-learn: Machine Learning in Python, Packt Publishing (November 25, 2013)
6)	Paul Gries, Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.
7)	John Grayson, Python and Tkinter Programming, Manning Publications; First Edition edition (January 2000)

List of the Laboratory Experiments:	
Module	**Contents**
1.	Write a program to demonstrate different number data types in Python.
2.	Write a program to perform different Arithmetic Operations on numbers in Python
3.	Write a program to create, concatenate and print a string and accessing sub- string from a given string.
4.	Write a program to create, append, and remove lists in python.
5.	Write a program to demonstrate working with tuples in python
6.	Write a program to demonstrate working with dictionaries in python.
7.	Write a python program to find largest of three numbers.
8.	Write a Python program to convert temperatures to and from Celsius, Fahrenheit.
9.	Write a Python script that prints prime numbers less than 20.
10.	Write a python program to find factorial of a number using Recursion.
11.	Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
12.	Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
13.	Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

14.	Write a program to generate different sinusoidal signal and plot it using Matplotlib.
15.	Using scipy's quad function, write a program that solves the following integral numerically: $I = \int_1 \cos(2\pi x)\, dx$.
16.	Write a function with name plot quad which takes the same arguments as the quad command (i.e. f, a and b) and which • (i) creates a plot of the integrand f(x) and • (ii) computes the integral numerically using the quad function. The return values should be as for the quad function.
17.	Write a python program to retrieve elements of an array using indexing, sort them in order. Also write a program to print stars to form a right-angled triangle and equilateral triangle
18.	Write a python program to find transpose of a matrix and to multiply two matrices.
19.	Write a Python program to calculate gross salary and net salary of employee. Take user input for basic salary. Gross salary= basic +DA+HRA; Net salary= Gross salary-PF-Income tax. DA is 80% of basic salary; HRA 15% of basic; PF is 12% of basic; Tax is 10% of gross salary.

Term Work:

Term work should consist of 10 experiments

1. Journal must include at least 2 assignments.
2. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work
3. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

Continuous assessment exam

Based on the subject and related lab of **ISL60**3

Program Structure for Third Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISM601	Mini Project – 2B	-	2	-	1	-	1

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Se Exam	Ex Dur (Hrs)			
		Mid Test (MT)	CA *					
ISM601	Mini Project – 2B	–	–	–	–	25	25	50

Objectives: The course is aimed	
1	To acquaint with the process of identifying the needs and converting it into the problem.
2	To familiarize the process of solving the problem in a group.
3	To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4	To inculcate the process of self-learning and research.

Outcomes:	
On successful completion of course learner/student will be able to	
1.	Identify problems based on societal /research needs.
2.	Apply Knowledge and skill to solve societal problems in a group.
3.	Develop interpersonal skills to work as member of a group or leader.
4.	Draw the proper inferences from available results through theoretical/ experimental/simulations.
5.	Analyse the impact of solutions in societal and environmental context for sustainable development.
6.	Use standard norms of engineering practices
7	Excel in written and oral communication.
8	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
9	Demonstrate project management principles during project work.

Guidelines for Mini Project	
1)	Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.

2)	Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
3)	Students' hall submits implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
4)	A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
5)	Faculty supervisor may give inputs to students during mini-project activity; however, focus shall be on self-learning.
6)	Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/supervisor.
7)	Students shall convert the best solution into working/ software model using various components of their domain areas and demonstrate.
8)	The solution to be validated with proper justification and report to be compiled in the standard format.
9)	With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini-Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e., Mini Project 1 in semester III and IV. Similarly, Mini-Project 2 in semesters Vand VI.
10)	However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini-Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case-by-case basis.

Guidelines for Assessment of Mini-Project:
Term Work

1)	The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
2)	In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.

3)	Distribution of Term work marks for both semesters shall be as below; Marks awarded by guide/supervisor based on logbook 10 Marks Marks awarded by review committee 10 Marks Quality of Project report 05 Marks

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on presentation given by students group.
  - First shall be for finalization of problem
  - Second shall be on finalization of proposed solution of problem.
- In second semester expected work shall be procurement of components/systems, building of working/software prototype, testing and validation of results based on work completed in an earlier semester.
  - First review is based on readiness of building working prototype/software model to be conducted.
  - Second review shall be based on poster presentation cum demonstration of working/software model in last month of the said semester.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including,
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalization of problem and proposed solution

Second shall be for implementation and testing of solution

Assessment criteria of Mini-Project. **Mini Project** shall be assessed based on following criteria;	
1)	Quality of survey/need identification
2)	Clarity of Problem definition based on need.
3)	Innovativeness in solutions
4)	Feasibility of proposed problem solutions and selection of best solution
5)	Cost effectiveness
6)	Societal impact
7)	Innovativeness
8)	Cost effectiveness and Societal impact
9)	Full functioning of working model as per stated requirements
10)	Effective use of skillsets
11)	Effective use of standard engineering norms
12)	Contribution of an individual's as member or leader
13)	Clarity in written and oral communication

- In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.
- In case of **half year project** all criteria in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini-Project Practical/Oral Examination:	
1)	Report should be prepared as per the guidelines issued by the Department.
2)	Mini Project shall be assessed through a presentation and demonstration of working /software model by the student project group to a panel of Internal and External Examiners preferably from industry or research organizations having experience of more than five years approved by Head of Institution.
3)	Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on following points;	
1)	Quality of problem and Clarity
2)	Innovativeness in solutions
3)	Cost effectiveness and Societal impact
4)	Full functioning of working model as per stated requirements
5)	Effective use of skillsets
6)	Effective use of standard engineering norms
7)	Contribution of an individual's as member or leader
8)	Clarity in written and oral communication