V. E. S. Institute of Technology

B. E.

Instrumentation Engineering

(Semester – VIII)

Autonomy Syllabus

Effective A. Y. 2023-24

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract. Tut.	Theory	Pract.	Tut.	Total
ISC801	Instrument and System Design	3	--	3	--		3
ISDOC801X	Department level elective – 4	3	--	3			3
ISDOC802X	Department level elective – 5	3	--	3	--		3
IOC802X	Institute level elective –2	3	--	3	--		3
ISL701	Instruments and System Design - Lab	--	2	--	1		1
ISL802X	Department level elective – 4 -Lab	--	2	--	1		1
ISP801	Major Project-II	--	12#	--	6		6
Total		**12**	**16**	**12**	**8**		**20**

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA*					
ISC801	Instrument and System Design	20	20	60	2	25	--	**125**
ISDOC801X	Department level elective – 4	20	20	60	2	--	--	**100**
ISDOC802X	Department level elective – 5	20	20	60	2	--	--	**100**
IOC802X	Institute level elective–2	20	20	60	2	--	--	**100**
ISL801	Instrument and System Design – Lab	--	--	--	--	25	25	**50**
ISL802X	Department level elective – 4 -Lab	--	--	--	--	25	25	**50**
ISP801	Major Project-II	--	--	--	--	100	50	**150**
Total		**80**	**80**	**240**	**8**	**175**	**100**	**675**

# Indicates the workload of Learner (Not Faculty), for Major Project

Students group and a load of faculty per week.

Major Project - I and II:

Students can form groups with a minimum 2 (Two) and not more than 4(Four)

Faculty Load: In Semester VIII – 1-hour per week per project group

Institute level elective – 1 (Semester- VII)

IOC7011	Product Lifecycle Management	IOC7016	Cyber Security and Laws
IOC7012	Reliability Engineering	IOC7017	Disaster Management and Mitigation Measures
IOC7013	Management Information System	IOC7018	Energy Audit and Management
IOC7014	Design of Experiments	IOC7019	Development Engineering
IOC7015	Operation Research		

Department level elective – 4 (Semester- VIII)

ISDOC 8011	Digital Control System	**Lab work**
ISDOC 8012	Expert System	
ISDOC 8013	Digital Image Processing	
ISDOC 8014	Internet of Things	
ISDOC 8015	Advanced Biomedical Instrumentation	

Department level elective – 5 (Semester-VIII)

ISDOC 8021	Advanced Digital Signal Processing	**No Lab work**
ISDOC 8022	Building Automation	
ISDOC 8023	Functional Safety	
ISDOC 8024	Power Plant Instrumentation	
ISDOC 8025	Optimal Control System	

Institute level elective–2 (Semester- VIII)

IOC8021	Project Management	IOC8026	Research Methodology
IOC8022	Finance Management	IOC8027	IPR and Patenting
IOC8023	Entrepreneurship Development and Management	IOC8028	Digital Business Management
IOC8024	Human Resource Management	IOC8029	Environmental Management
IOC8025	Professional Ethics and Corporate Social Responsibility		

Note: As per above Examination Scheme, the Minimum marks for passing are as follows –

Max. Marks	**Min. marks**
80	32
50	20
25	10
20	8

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISC801	Instrument and System Design	3	-	3	-	-	3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Dur (Hrs)			
		Mid Test (MT)	CA *					
ISC801	Instrument and System Design	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISC801	Instrument and System Design	3

Course Objectives:	
1	To impart knowledge of selection and design considerations of transducers along with their calibration techniques.
2	To make the students capable of sizing the control valve.
3	To impart the students' knowledge about the types, sizing of control panels, and standards.
4	To make the students capable to design electronic products, control room layout, and its environment.
5	To familiarize students with the concept of reliability engineering.

Course Outcomes:	
The students will be able to	
1.	Select, design and calibrate transducers
2.	Select and size the control valves and actuators.
3.	Estimate valve noise and predict cavitation.
4.	Apply knowledge to design the control panels and control room.
5.	Design electronic products and enclosures.
6.	Define the terms used in Reliability engineering.

Module	**Detailed Content**	**No. of Hours**
1	**Design of Transducers:** An overview of static and dynamic performance characteristics of Transducers. Selection criteria, design considerations, calibration and installation for flow, temperature, pressure and level transducers.	07
2	**Design of Control Valve:** Control valve terminology, Review of flow equations. Valve selection and sizing for liquid service, gas or vapor service, flashing liquids and mixed	12

	phase flow, Actuator sizing. Selection criteria and design consideration of pressure safety relief valves and rupture discs.	
3	**Cavitation and Noise estimation:** Control valve noise, sources of noise, noise prediction, abatement of noise. Control valve cavitation, effects, preventing cavitation, Prediction of cavitation.	07
4	**Control Panel and Control room design** Need for control panel, Types, selection guidelines, Design considerations - size, construction and IP classification, NEMA standard. GA Diagrams, Power wiring and distribution, Earthing scheme. Panel ventilation, cooling and illumination. Operating consoles- ergonomics. Wiring accessories- ferules, lugs, PVC ducts, spiral etc. Wire sizes and color coding. Packing, **Pressurized panels**- X, Y, and Z Purging for installation in hazardous areas. Ex-proof panels. Intrinsic safe (IS) and non-intrinsic safe (non-IS) cables design. **Control Room Design**: Layout and environment, modern control room layout.	05
5	**Electronic product design:** System Engineering, Ergonomics, phases involved in electronic product design. **Enclosure Design:** Packing and enclosures design guidelines, Grounding and shielding, front panel and cabinet design of an electronic product.	04
6	**Reliability engineering:** Reliability concepts, causes of failures, bath tub curve, Quality and reliability, MTTF, MTBF, and MTTR. Availability and Maintainability. Redundancy and redundant systems.	04
	Total	**39**

Text Books:	
1	Kim R Fowler, Electronic Instrument Design, Oxford University-1996.
2	Bal Guruswamy E,“Reliability”TataMcGraw-HillPub.co.NewDelhi,1999.

References:	
1	Les Driskell, “Control valve sizing”, ISA.
2	Bela G. Liptak, “Instrument Engineer ‘s Hand Book – Process Control”, Chilton Company, 3rdEdition, 1995
3	Andrew Williams, ―Applied instrumentation in the process industries‖, 2nd Edition, Vol. 1 &3, Gulf publishing company,1979.
4	Mourad Samiha & Zorian Yervant, “Principles of Testing Electronic Systems”, New York. John Wiley & Sons,2000.
5	Lewis EE, “Introduction to Reliability Engineering” (2nd), NewYork.JohnWiley&Sons,1996.
6	Anand M.S, “Electronic Instruments and Instrumentation Technology”, New Delhi. Prentice Hall of India, 2004.
7	“Manual on product design”: IISc C.E.D.T.
8	R. W. Zape, ―” Valve selection hand book” third edition, Jaico publishing house,2003.
9	Curtis Johnson, “Process Control Instrumentation Technology”, PHI/Pearson Education2002.

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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8011	Digital Control System	3	-	3	-	-	3

Course Code:	Course Title	Credit
ISDOC8011	Digital Control System	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*					

ISDOC8011	**Digital Control System**	20	20	60	2	-	-	100

Course Code:	**Course Title**	**Credit**
ISDOC8011	**Digital Control System**	**3**

Course Objectives:	
1	To familiarize the students with the basic knowledge of discretization.
2	To familiarize the students with the discrete-time representations of systems for the analysis and design of the digital control.
3	To equip the students to determine the stability of the digital control

Course Outcomes:	
Students will be able to	
1.	Distinguish the continuous-time and discrete-time control systems and their working principles.
2.	Discretize the given continuous-time system.
3.	Represent the given discrete-time system in frequency and time-domain.
4.	Perform the transformation of the system in to canonical forms and compute the state trajectory via state transition matrix.
5.	Determine the stability of discrete-time control systems in frequency and time-domain.
6.	Design controller and observer for discrete-time control systems.

Module	Detailed Content	No. of Hours
1	**Introduction** Block diagram of a typical digital control system, Practical examples of digital control systems, advantages and limitations of discrete-time control systems over continuous-time control system. Continuous time signals versus discrete-time signals, data conversion and quantization, sampling as impulse modulation, sampling period considerations, aliasing and folding, reconstruction of analog signals, zero order hold, first order hold.	**06**
2	**Principles of Discretization** Impulse sampling, data hold via zero-order hold and first-order hold with their transfer functions, discretization of the continuous-time control system using- impulse invariance technique, step-invariance, finite difference approximation of derivatives and bilinear transformation, Mapping between s-plane and z-plane.	**06**
3	**Representation of digital control systems** Linear difference equations, pulse transfer function, input output model, examples of first and second order continuous and discrete time systems, Construction of signal flow graph (SFG) for discrete-time control systems, computation of pulse transfer function via SFG.	**06**
4	**State-space Analysis of Discrete-time Systems** State-space space representation of discrete-time system. State-space representation of the system in canonical forms namely- controllable, observable and diagonal/Jordan canonical forms. Similarity transformations, non-uniqueness of state-space models, invariance of eigenvalues under similarity transformation. System transformation to diagonal/Jordan form. State transition matrix (STM), solution to the discrete-time state equations via STM.	**07**
5	**Stability Analysis of Discrete-time Systems** Stability analysis of the system system via frequency-domain approaches-analysis via pole locations in z-plane, Jury's stability test, bilinear transformation and Routh stability criterion. Stability analysis of the system	**06**

	system via time-domain Lyapunov approach- Lypunov functions, Lyapunov stability theorems, Lyapunov equation for linear-time invariant discrete-time systems.	
6	**State Feedback Controller and Observer Designs for of Discrete-time Systems** Concepts of controllability, stabilizability, observability and detectability. Principle of duality. Effect of discretization of continuous time system on controllability and observability properties. Construction of a transformation to transform the system into controllable and observable forms for linear time-invariant single-input single-output systems. Design of state feedback control, Ackermann's formula to compute the state feedback gain for pole-placement, deadbeat control design. State observers, design of full state observer using pole-placement methods.	**08**
	Total	**39**

Text Books:	
1	Katsuhiko Ogata, Discrete Time Control Systems, Pearson Education Inc., 1995.
2	M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, 2ndEdition, 2003.
	Benjamin Kuo, "Digital Control Systems", Saunders College Publishing, 1992.

References:	
1	G. Franklin, J. Powel, M. Workman, *Digital Control of Dynamic Systems*, Pearson Education, 3rd Edition, 2003.
2	M. Fadali Antonio Visioli, Digital control Engineering Analysis & Design, Academic press, 2012**.**
3	Richard J. Vaccaro, "Digital Control", McGraw Hill Inc., 1995.
4	Ashish Tewari, "Modern Control System Design with MATLAB", John Wiley, Feb. 2002.
5	Joe H. Chow, Dean K. Frederick, "Discrete Time Control Problems using MATLAB", Thomson Learning, 1st Edition, 2003.

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)	6 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8012	Expert 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 *					
ISDOC8012	Expert System	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISDOC8012	Expert System	3

Course Objectives:	
1.	To provide an understanding on the fundamentals of Artificial Intelligence and Expert System.
2.	To provide an understanding on the fundamentals of neural network.
3.	To provide an understanding on the fundamentals of fuzzy systems.
4.	To provide an understanding of Neuro fuzzy system.
5.	To provide an understanding of applications based on Artificial Intelligence and Expert System.

Course Outcomes:	
The students will able to	
1.	Interpret the concepts of Artificial Intelligence and Expert System.
2.	Explain artificial neural network.
3.	Compare advanced artificial neural network algorithms.
4.	Define Fuzzy set, rules and membership function and also defuzzification for a given problem.
5.	Examine various hybrid systems.
6.	Apply AI and expert systems algorithms for different domains.

Module	**Detailed Content**	**No. of Hours**
1	**Introduction to Artificial Intelligence and Expert System** Evolution, Definition, Features, Importance, Advantages, Disadvantages, limitations/issues, comparison.	04

2	**Artificial Neural Network (ANN)** Evolution, Biological Inspiration, Single and Multi-Input Neurons, Weights, Transfer Functions, Momentum, Neural network learning rule, Back propagation algorithm (BPA), Performance Index, Batch vs. Incremental Training, Single layer and multi-layer Perceptron classifiers.	08
3	**Advance Neural Networks** Recurrent Neural Networks, LSTM, Gated RNN, Convolutional Neural Networks, Auto Encoders.	08
4	**Fuzzy Logic** Fuzzy sets, Operation on Fuzzy sets, Fuzzy membership functions, Rule base, De-fuzzification, Mamdani and Sugeno Fuzzy Inference System.	07
5	**Hybrid Systems** Neuro fuzzy systems –Adaptive neuro fuzzy inference system (ANFIS) – Optimization of membership function and rule base. Familiarization of ANFIS Tool Box.	05
6	**Case study** Problem Selection, Conceptualization, Formalization, Knowledge Acquisition, Prototype Construction, Implementation, Evaluation. Process control, Electrical Engineering, Speech processing, medical diagnosis	07
	Total	**39**

Text Books:

1.	Gupta, Itisha, and Garima Nagpal. *Artificial Intelligence and Expert Systems*. Stylus Publishing, LLC, 2020.
2.	Hagan, Martin T., Howard B. Demuth, and Mark Beale. *Neural network design*. PWS Publishing Co., 1997.
3.	Stamatios V. Kartalopolous, Understanding Neural Network and Fuzzy Logic., PHI Pvt Ltd.
4.	Kishan Mehrotra, Elements of ANN., 2nd Editon, Penram International Publishing(I) Pvt. Ltd.

5.	Donald A. Waterman, ―A Guide to Expert Systems‖,Addison-Wesley Publishing Company

References:

1	Laurene. V, Fausett, ―Fundamentals of Neural Networks, Architecture, Algorithms, and Applications‖, Pearson Education,2008.
2	Timothy J, Ross, ―Fuzzy Logic with Engineering Applications, Wiley, Third Edition, 2010.
3	Zimmermann. H.J, "Fuzzy set theory-and its applications"- Springer international edition, 2011.
4	Miller W. T, Sutton .R. Sand Webrose .P.J,―Neural Networksfor Control‖, MIT Press, 1996.
5	Kevin Nightand Elaine Rich, Nair B., ―Artificial Intelligence (SIE)‖, McGraw Hill- 2008.
6	Dan W. Patterson, ―Introduction to AI and ES‖, Pearson Education, 2007. (Unit-III).
7	Peter Jackson, ―Introduction to Expert Systems‖,3rd Edition, Pearson Education,2007.
8	Stuart Russel and Peter Norvig ―AI– A Modern Approach‖, 2nd Edition, Pearson Education2007
9	Deepak Khemani ―Artificial Intelligence‖, Tata McGraw Hill Education2013.
10	Laurance Fausett Englewood Cliffs, N.J., _ Fundamentals of Neural Networks ‘, Pearson Education,1992.
11	TimothyJ. Ross,_Fuzzy Logic with Engineering Applications‘, Tata McGrawHill,1997.
12	S.N. Sivanandam and S. N. Deepa, Principles of Soft computing, Wiley India Edition,2nd Edition,2013
13	Simon Haykin, _Neural Networks ‘, Pearson Education,2003.
14	John Yen & Reza Langari, _Fuzzy Logic – Intelligence Control & Information ‘, Pearson Education, New Delhi, 2003.

15	15.M.Gen and R, Cheng, Genetic algorithms and optimization, Wiley Series in Engineering Design and Automation, 2000.

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)	7 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

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Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8013	Digital Image Processing	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*					
ISDOC8013	Digital Image Processing	20	20	60	2	-	-	100

Course Code:	Course Title	Credit
ISDOC8013	**Digital Image Processing**	**3**

Course Objectives: Students will be able to-	
1.	To introduce the basic elements of digital image processing.
2.	To familiarize with 2-D Transforms of digital images.
3.	Ability to use image enhancement and segmentation techniques.
4.	To analyze image compression and object recognition algorithms.
5.	To introduce the basic elements of digital image processing.
6.	Recognize and classify objects and patterns in digital images.

Course Outcomes:	
1.	Interpret the basic elements of digital image processing.
2.	Analyze digital images using 2-D transforms.
3.	Apply spatial filtering and image enhancement techniques in the frequency domain.
4.	Analyze image segmentation techniques.
5.	Apply different image compression techniques.
6.	Recognize and classify objects and patterns in digital images.

Module	Detailed Content	No. of Hours
1	**Fundamentals of Image Processing:** Digital image representation, fundamental steps in image processing, Elements of digital image processing systems, Image fundamentals: Gray, Color and Black and white. Color image models: RGB, CMY, HIS and other models. Various Image Format, Sampling and quantization, Relationship between pixels, Statistical parameters (with respect to DIP): Mean, standard deviation, variance, SNR, PSNR etc.	06
2	**Image transforms:** Basic transformations, Perspective transformation, 2-D Transforms: Fourier transform, Discrete cosine transform, Short time Fourier transform, Gabor transform, Radon transform, SVD, Wavelet Transforms, Hough Transform, Watershed Transform	07
3	**Image Enhancement:** Enhancement by point processing, spatial filtering, enhancement in the frequency domain. Contrast intensification: linear stretching, non-linear stretching, histogram specification, low contrast stretching. Smoothing: Image averaging, mean filter, order statistics filter, edge preserving smoothing. Sharpening: High pass filtering, homomorphic filtering.	07
4	**Image Analysis and Segmentation:** Detection of discontinuities, edge linking and boundary detection, thresholding, region -oriented segmentation Representation and description: Representation schemes, descriptors, regional descriptors, pattern and pattern classes, Introduction Classifiers.	06
5	**Image Compression:** Need, Lossy and lossless compression, Huffman, RLE, LZW, Vector Quantization, Shift codes, Arithmetic coding, BTC, Transform based compression: JPEG, MPEG, JPEG 2000, etc., properties of image compression schemes.	06
6	**Object Recognition and Applications:** Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing	07
	Total	**39**

Text Books:	
1.	Rafael C. Gonzalez and Richard E. Woods, *"Digital Image Processing",* Pearson Education, 2007.
2.	S Sridhar, *"Digital Image Processing",* Oxford University Press, 2016.
3.	A. K. Jain, *"Fundamentals of Digital Image Processing",*PHI, 1994
4.	W. K. Pratt, *"Digital Image Processing",*John Wiley and Sons, 1996

References:	
1	Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, *"Digital Image Processing Using MATLAB",* Tata McGraw Hill Publication, 2009.
2	S Jayaraman, S Esakkirajan, T Veerakumar, *"Digital Image Processing",* Tata McGraw Hill, 2019.

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)	8 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8014	Internet of Things (IOT)	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 *					
ISDOC8014	Internet of Things (IOT)	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8014	**Internet of Things (IOT)**	**3**

Course Objectives:	
1.	To teach fundamentals of IoT
2.	To study data and knowledge management and use of devices in IoT technology.
3.	To understand IoT architecture and Integration of embedded devices with IoT
4.	To understand concept of IoT.
5.	To learn designing of industrial internet systems.
6.	To study overview of Android/ IOS app development tools and Internet of Everything

Course Outcomes:	
Students will be able to-	
1.	Demonstrate the knowledge of operation of IoT architecture
2.	Identify the various technologies for implementing IoT
3.	Discuss various communication Technologies used in IoT
4.	Discuss various communication models and protocols used in IoT
5.	Discuss about the role of cloud computing in IoT
6.	Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

Module	Detailed Content	No. of Hours
1	**Introduction to Internet of Things: An Overview**	04

	Introduction – Definition and characteristics of IoT, Physical design of IoT- Things in IoT, IoT protocol, Logical design of IoT – IoT functional blocks, IoT Communication Models, IoT communication APIs.	
2	**IoT Enabling Technology** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems. **IOT Levels and Deployment Templates.**	04
3	**Introduction to Communication Technologies** 802.15.4, ZigBee, BLE, WiFi, LORA, GSM basic protocol topologies, data rate, range, power, computations/bandwidth, QoS	10
4	**Communication Model and Protocols** M2M vs IOT, Resource Management, Registration, Discovery Data Exchange Formats - XML & JSON, MQTT Protocol, RESTFul Architecture, HTTP REST Model, CoAP Protocol	09
5	**Basics of Cloud Computing** Cloud Based Architecture, Basics of Virtualization º Specific Characteristics that Define a Cloud, Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) Cloud Delivery Models, Public Cloud, Private Cloud, Hybrid Cloud and Community Cloud Deployment Models, Benefits, Challenges and Risks of Cloud Computing Platforms and Cloud Services	06
6	**Case Studies of IOT** Home (Smart Lighting and Intrusion detection), Cities (Smart Parking, Garbage collection), Environment (Pollution detection, Forest Fire Detection), Power (Smart Grid), Retail (Inventory Management), Logistics (Fleet Tracking) Industry (Machine Diagnosis & Prognosis), Health (Monitoring and Detection), Agriculture (Green House Monitoring, Animal Husbandry.	06
	Total	**39**

Text Books:	
1	Vijay Madisetti and Arshdeep Bahga, ―Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.

2	Cloud Computing Black Book Edition-2014 by Jagannath Kallakurchi Wiley India

References:

1	Francis DaCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013
2	Wimer Hazenberg, Menno Huisman and Sara Cordoba Rubino, ―Meta Products: Building the Internet of Things‖, BIS publisher

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8015	Advanced Biomedical Instrumentation	3	--	3			3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Dur (Hrs)			
		Mid Test (MT)	CA*					
ISDOC8015	Advanced Biomedical Instrumentation	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8015	Advanced Biomedical Instrumentation	3

Course Objectives:	
1.	To make students understand the working principle and application of various Advanced Biomedical Instruments used in Biomedical field
2.	To make students understand the working and applications of imaging techniques in depth.

Course Outcomes:	
The students will be able to	
1.	Identify various Bio-potential with their specifications, design signal conditioning for the same and perform their measurements.
2.	Discuss various prosthetic devices and to identify their parameters for proper operation.
3.	Explain the principle and working of various patient monitoring and telemetry systems.
4.	Distinguish between the various medical imaging techniques based on the principles and concepts involved in them.
5.	Discuss the applications of fibre optics and lasers in Biomedical.
6.	Describe the significance of radiation, electrical and fire safety in biomedical measurement.

Module	Detailed Content	No. of Hours
1	**Introduction to Bio-potential Measurement:** Measurement of membrane potentials, Bio-potential amplifiers, ECG, EEG and EMG measurements, Design of ECG, EEG and EMG signal conditioning circuit, EMG Quantification circuit.	06
2	**Prosthetic devices:** Pacemakers – types and constructional details, Design of asynchronous pacemaker using op-amp and 555 timer, Implantable defibrillators and cardiovertors, Cochlear implants – principle, working and construction, Retinal	08

	implants - principle, working and construction, Wearable Artificial Kidney, Functional electrical stimulator (FES) for neural and muscular stimulation.	
3	**Patient monitoring system:** Bedside monitor, Central Nurse station, Telemetry system and Telemedicine.	03
4	**Advanced Medical Imaging:** Computed Tomography (CT) - Details of Acquisition, Digital image reconstruction and display, Magnetic resonance imaging (MRI) – image acquisition and reconstruction techniques, Nuclear Imaging – nuclear radiation detectors, rectilinear scanner, gamma camera, positron emission tomography (PET), single photon emission computer tomography (SPECT)	10
5	**Fibre optics and Lasers for Biomedical applications:** Optical Sources and Detectors: Introduction, LED's, LASER diodes, Photo detectors. Introduction to Fibre Couplers and Connectors, Lasers and its types, properties of lasers and interaction with tissues, Basic endoscope and laparoscope system.	08
6	**Radiation, Electrical and Fire Safety:** Radiation safety, Safety precautions, Hazardous effects of radiation, allowed levels of radiation, Electrical safety, sources of shock, macro & micro shocks, monitoring and interrupting the operation from leakage current, Elements of fire, causes of fire & fire protection.	04
	Total	**39**

Text Books:

1	Leslie Cromwell, "Biomedical Instrumentation and Measurements", 2nd Edition, Pearson Education, 1980.
2	John G. Webster, "Medical Instrumentation", John Wiley and Sons, 4th edition, 2010.
3	R. S. Khandpur, "Biomedical Instrumentation", TMH, 2004
4	Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", PHI/Pearson Education, 4th edition, 2001.

References:

1	Richard Aston, "Principles of Biomedical Instrumentation and Instruments", PH, 1991.
2	John E Hall, Gyton's Medical Physiology, 12th edition, 2011
3	L. E. Baker L. A. Geddes, "Principles of Applied Biomedical Instrumentation", John Wiley and Sons, 3rd Edition, 1991.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8021	Advanced Digital Signal Processing	3	--	3	--		3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Dur (Hrs)			
		Mid Test (MT)	CA*					
ISDOC8021	Advanced Digital Signal Processing	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8021	**Advanced Digital Signal Processing**	**3**

Course Objectives:	
1.	To introduce the basic concepts of multi-rate signal processing.
2.	To familiarize with linear prediction and power spectrum estimation techniques.
3.	Ability to apply the time-frequency transforms in signal analysis.
4.	To understand the basic concepts of Digital Signal Processor and adaptive filtering for practical applications.

Course Outcomes:	
Students will be able to:	
1.	Describe the basic concepts of multi-rate DSP.
2.	Apply linear prediction algorithms in real-time applications.
3.	Estimate the power spectrum for random signals.
4.	Apply adaptive filters in noise and echo cancellation applications.
5.	Analyze the signals in time-frequency domain using STFT and Wavelets.
6.	Implement real-time signal processing applications using Digital Signal Processor.

Module	Detailed Content	No. of Hours
1	**Multi-rate digital signal processing**: Basic multi-rate operation (up sampling, down sampling), Efficient structures for decimation and interpolation, Decimation and interpolation with polyphase filters, non-integer sampling rate conversion, Efficient multi-rate filtering Applications.	06

2	**Linear prediction:** Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.	07
3	**Power spectral estimation**: Periodogram based nonparametric methods: Periodogram, Bartlett's method, Welch's method, Blackman-Tukey method Parametric methods for power spectrum estimation: ARMA modelling, Yule- Walker equation and solution.	06
4	**Adaptive filtering**: Principles of Adaptive filtering, LMS and RMS Algorithms, Applications in noise and echo cancellation, Homomorphic Signal Processing, homomorphic system for convolution, properties of complex-spectrum, Applications of homomorphic deconvolution.	07
5	**Time-frequency Analysis**: Fourier Transform: Its power and Limitations, Short Time Fourier Transform, The Gabor Transform, Discrete Time Fourier Transform and filter banks, Continuous Wavelet Transform, Discrete Wavelet Transform, Haar Wavelet, Daubechies Wavelets.	06
6	**Digital Signal Processor** (TMS320C67XX, ADSP-21XX, SHARC): Introduction to fixed point and floating-point DSP processor, Features of DSP processor, architecture of DSP processor, architecture features: computational units, bus architecture memory, data addressing, address generation unit, program control, program sequencer, pipeling, interrupts, features of external interfacing, on-chip peripherals, hardware timers, host interface port, clock generators, SPORT.	07
	Total	**39**

Text Books:

1	J. Proakis , Charles M. Rader, Fuyun Ling, Christopher L. Nikias, „Advanced Digital Signal Processing“, (Macmillan Coll Div) (1992)
2	Glenn Zelniker, Fred J. Taylor, „Advanced Digital Signal Processing“, (CRC Press) (1994)

References:

1	A.V. Oppenheim and R.W. Schafer, "Discrete time Signal Processing", (Prentice Hall) (1992)

2	Haykins, "Adaptive Filter theory", (Prentice Hall) (1986)
3	Dr. Rulph Chassaing , " Digital Signal Processing and Application with the TMS 320c6713 and TMS 320c6716", Wilay Publication.
4	Raghuveer. M. Rao, Ajit S. Bopardikar, Wavelet Transforms, Introduction to Theory and applications, Pearson Education, Asia, 2000.
5	Introduction to Wavelets and Wavelet Transform: C. S. Burrus, Ramesh and A. Gopinath, Prentice Hall Inc.

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)	10 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 needs to be solved.

Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8022	Building Automation	3	--	3	--		3

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Dur (Hrs)			
		Mid Test (MT)	CA*					
ISDOC8022	Building Automation	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8022	Building Automation	3

Course Objectives:	
1.	To brief students with origin and evolution of building automation.
2.	To train them with architecture and operation of BAS.
3.	To facilitate them for designing automation system for intelligent building.
4.	Develop technique for preparation of various documents required for design requirement of safety building.

Course Outcomes:	
The students will be able to:	
1.	Explain the concept of intelligent building and BAS.
2.	Select the hardware and design of HVAC in building automation system.
3.	Discuss the concept of energy management system.
4.	Design and implement the safety system for building.
5.	Design security and video management system for building.

Module	**Detailed Content**	**No. of Hours**
1	**Introduction to intelligent buildings and BAS:** Definitions of intelligent building, Intelligent architecture and structure, Facilities management vs. intelligent buildings, Technology systems and evolution of intelligent buildings. **Building Automation System:** Features, Characteristics, Drawbacks of Building Automation system. Various Systems of Building Automation – Building Management System, Energy Management System, Security System, Safety System, Video Management System.	05

2	**HVAC system:** Introduction, HVAC, Components of HVAC, AHU, Control of CAV systems, Control of VAV systems, AC Plant Room – Concept, Components, Refrigeration Cycle Working Principle, Chiller Sequencing, AC Plant Sequencing. Feedback Control Loops, optimal control methods used for HVAC systems, Direct Digital Control (DDC) Psychrometry –Concept, ASHRAE Psychrometric Chart, Meaning of Various Terms – DBT, WBT, ST, RH, DPT, Sensible & Latent Cooling & Heating, Numerical.	10
3	**Energy Management System:** Concept, Energy Meters, Types, Meter Networking, Monitoring Energy Parameters, Analysis of Power Quality – Instantaneous Power, Active Power, Reactive Power, Power Factor, Voltage, Current. Effect of Power Quality on Energy Consumption, Energy Reports, Energy Conservation, Importance of Energy Saving.	04
4	**Safety Systems:** Introduction, Fire –Meaning, Fire Development Stages, Fire Sensors & Detectors, Detector Placement, and Detectors Required for Various Applications. Fire Extinguishing Principles, Fire Extinguishers & Its Classification. Fire Alarm System – Controllers, Components, Features, Concept of Fire Loop & Fire Devices, 2-Wire & 4-Wire Loops, Working Principle, System Description, Pre-alarm, Alarm, Trouble, Fault, Differences, Cable Selection, Installation Guidelines Best Installation Practices, NFPA and IS2189 standards	08
5	**Security Systems:** Introduction, Access Control – Concept, Components, Types, Features, Card Technologies, Protocols, Controllers, Concept of Anti passback, Biometrics, Cabling, Intrusion Detection System – Sensors, Working Principle **Video Management:** Video Door phone, CCTV Cameras, CCD Camera Basics, Traditional CCTV System, Video Recording, Drawbacks, Digital Video Recording, Features, Functionalities, Digital Vs Analog Recording, Digital Video Management System – Introduction, Features, Advancements& Differences from Earlie Video Techniques ,TCP/IP Networking Fundamentals, System Network Load Calculations, Network Design.	08
6	**Integrated Systems:** Introduction, Integration of Building Management System, Energy Management System, Safety System, Security Systems &	04

	Video Management, Benefits of Integrated Systems, Challenges, Future Prospects of Integrated Systems.	
	Total	**39**

Text Books:

1	Shengwei Wang, *"Intelligent Buildings and Building Automation",* 2009.
2	Reinhold A. Carlson, Robert A., Di Giandomenico, *"Understanding Building Automation Systems: Direct Digital Control, Energy Management, Life Safety, Security Access Control, Lighting, Building",* 1991

References:

1	Roger W. Haines, *"HVAC system Design Handbook",* 2003.
2	National Joint Apprenticeship & Training Committee, *"Building Automation System Integration with Open Protocols: System Integration with Open Protocols",* 2009.
3	John I. Levenhagen and Donald H. Spethmann, *"HVAC Controls and Systems",* 1992.
4	James E. Brumbaugh, *"HVAC fundamentals",* 2004

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8023	Functional Safety	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 *					
ISDOC8023	Functional Safety	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8023	Functional Safety	3

	Course Objectives:
1	To make the students aware of basic concepts of safety instrumented system, standards and risk analysis techniques.

Course Outcomes:	
The students will be able to:	
1.	Define the role of Safety instrumented system in the industry.
2.	Explain process and safety control with SIS technologies
3.	Describe steps involved in Safety life cycle
4.	Calculate combined probability for different types of events.
5.	Analyse the potential hazards in the process.
6.	Determine the Safety integrity level.

Module	Detailed Content	No. of Hours
1	**Introduction:** Safety Instrumented System (SIS) - need, features, components, difference between basic process control system and SIS, Risk: how to measure risk, risk tolerance, Safety integrity level, safety instrumented functions. Standards and Regulation – HSE-PES, AIChE-CCPS, IEC-61508, IEC 61511 (2-16), ANSI/ISA-84.00.01-2004 (IEC 61511 Mod) & ANSI/ISA –84.01-1996.9, NFPA 85.10, API RP 556, API RP 14C, OSHA (29CFR 1910.119 – Process Safety Management of Highly Hazardous Chemicals), IEC61513, IEC 60601, ISO 26262, IEC 62443	06

2	**Process Control** – Active / Dynamic, Safety Control – Passive / Dormant, Demand Mode vs. Continuous Mode, Common Cause and Systematic or Functional Failures. **Protection Layers:** prevention and mitigation layers, SIS Technologies:Pneumatic Systems, Relay Systems, Solid State Systems, Microprocessors / PLC (Software based) Systems, voting logic in SIS	06
3	**Safety life cycle:** Standards and safety life cycle, analysis phase, tolerable risk, risk identification and hazard analysis, SIF identification, realisation phase, operations phase.	06
4	**Rules of Probability:** Assigning probability to an event, types of events and event combination, combining event probabilities, failure rate and probability, simplifications and approximations.	06
5	**Process Hazard Analysis:** Consequence analysis: Characterization of potential events, dispersion, impacts, effect zone,occupancy considerations, consequence analysis tools. Likelihood analysis: statistical analysis, fault propagation modeling - event tree analysis and fault tree analysis, reliability block diagram, markov analysis, Quantitative layer of protection analysis: multiple initiating events, estimating initiating event frequencies and IPL failure probabilities..	09
6	**Determining the Safety Integrity Level (SIL):** Evaluating Risk, Safety Integrity Levels, SIL Determination Method: As Low as Reasonably Practical (ALARP), Risk matrix, Risk Graph, Layers of Protection Analysis (LOPA)	06
	Total	**39**

References:

1	Paul Gruhn and H Jarry L. Cheddie," Safety Instrumented systems: Design, Analysis and Justification", ISA, 2nd edition, 2006

2	Dr. Eric W Scharpf, Heidi J Hartmann, Harlod W Thomas, "Practical SIL target selection: Risk analysis per the IEC 61511 safety Lifecycle", exida, 2012.
3	Ed Marszal, Eric W Scharpf, "Safety Integrity Level Selection", ISA.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8024	Power Plant Instrumentation	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 *					
ISDOC8024	Power Plant Instrumentation	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8024	Power Plant Instrumentation	3

	Course Objectives:
1	To create awareness of energy resources and its scenario in India and worldwide.
2	To study the concept of power generation using various resources.
3	To study the role of Instrumentation in power plants.
4	To study and compare various power plants for optimal performance.
5	To acquire students the knowledge about hazards and safety in handling power plants.

Course Outcomes:	
The students will be able to	
1.	Classify the energy generation resources.
2.	Illustrate operation and control of thermal power plant equipment.
3.	Select the sites for hydroelectric power plants and explain its operation.
4.	Explain the power generation and control of nuclear power plant.
5.	Describe the non-conventional energy resources.
6.	Compare different types of power plants.

Module	Detailed Content	No. of Hours
1	**Introduction:** Energy sources, their availability, worldwide energy production, energy scenario of India. Introduction to Power generation, load curve, load factor. Classification of energy generation resources.	4

2	**Thermal Power Plant**- Method of power generation, layout and energy conversion process. Types of Turbines & their control. Boilers and their control. Types of Generators and their control, Types of Pumps and Fans, Material handling system, study of all loops-water, steam, fuel etc.Schematics of Gas turbine and Diesel power plant.	10
3	**Hydroelectric Power Plant**- Site selection, Estimation electric power to be developed, classification of Hydro power plants. Types of Turbines for hydroelectric power plant, pumped storage plants, storage reservoir plants.	6
4	**Nuclear Power Plant –** Concept of energy generation from nuclear fission,control of chain reaction, schematics of Nuclear power plant, types of reactors, reactor control, safety measures.	6
5	**Non-conventional Energy Resources** – **Wind Energy:** Power in wind, wind power conversion, aerodynamics of wind turbine, types of wind turbine and their modes of operation, power control of wind turbines and detection of failure, Betz limit, Pitch & Yaw control, connection of wind mill on power grid, applications of wind energy, safety. **Solar Energy:** Solar resource, solar energy conversion systems. Solar PV technology: Block diagram of PV system, Detection of failure and performance monitoring of PV cell in the array of cells, connection of solar power on power grid, advantages and limitations. Solar thermal energy system: Principle, solar collector and its types, solar concentrator and its types, safety.	9
6	**Comparison of different types of power plant**: On the basis of Performance, efficiency, site selection, Economics-capital and running, safety. Introduction to Hybrid Power Generation concept. Introduction to Modern Biomass, Bio-fuels, Geothermal energy, Tidal energy and Ocean thermal energy.	4
	Total	**39**

The Industrial visit is recommended for understanding of different process loops and functioning of the industry.

Text Books:	
1	P. K. Nag, Power plant engineering, Fourth edition (2017), McGraw Hill Education.
2	K. Krishnaswamy, M. Ponni Bala, Power Plant Instrumentation, Second edition (2013), PHI.
3	R. K. Rajput, A Textbook of Power Plant Engineering,Fifth edition (2016), Laxmi Publications.

References:	
1	S.C.Arora, A.V. Domkundwar, Power Plant Engg.,(2013), Dhanpat Rai & Co.
2	B. H. Khan, Non-conventional energy resources, McGraw Hill, New Delhi.
3	Chetan Singh Solanki, Renewable energy Technology, Prentice Hall Publication.
4	S. P. Sukhatme, Solar Energy, Tata McGraw Hill, New Delhi.
5	G. D. Rai, Nonconventional energy sources, Khanna Publication.
6	Dickinson & Cheremision off, Solar Energy Technology vol I & II.
7	Tony Burton, David Sharpe, Nick Jenkins, Ervin Bossanyi, Wind Energy Handbook (2001), John Wiley & Sons, ISBN: 0471489972.
8	James Manwell, J. F. Manwell, J. G. McGowan, Wind Energy Explained: Theory, Design and Application (2002), John Wiley and Sons Ltd, ISBN: 0471499722
9	Z. Lubosny, Wind Turbine Operation in Electric Power Systems (2003), Springer-Verlag New York, Inc; ISBN: 354040340X.
10	Z. Lubosny, Wind Turbine Operation in Electric Power Systems (2003), Springer-Verlag New York, Inc; ISBN: 354040340X.
11	G.F. Gilman, Boiler Control Systems Engineering, 2005, ISA Publication.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISDOC8025	Optimal Control 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*					
ISDOC8025	Optimal Control System	20	20	60	2	--	--	100

Course Code:	Course Title	Credit
ISDOC8025	Optimal Control System	3

	Course Objectives:
1	To make students understand the optimal control problems their types and how to solve them by calculus of variation and dynamic programming approaches.
2	To make student to understand the linear regulator and tracking systems,

Course Outcomes:	
The students will be able to	
1.	Identify various optimal control problems with performance measure with minimum time, minimum fuel, minimum energy, terminal cost and general problems.
2.	Use the principle of calculus of variation to determine a function that minimizes a specified functional.
3.	Derive the necessary conditions for optimal control problem, and optimal law for the linear regulator problem.
4.	Understand applications of linear quadratic regulator and tracking systems.
5.	Apply variational calculus for solving discrete linear quadratic regulator and tracking problems.
6.	Study the method of dynamic programming leads to a functional equation that

Module	Detailed Content	No. of Hours
1	**Introduction**: Formulation of optimal control problem, Performance measure, selecting a performance measure.	04
2	**Calculus of variation I** Fundamental concepts: functional, Linearity of functional, closeness, increment, variation, maxima and minima of functional, fundamental theorem of calculus of variation.	08

	Extremum of functional of single function: fixed and free end point problems, Extremum of functional of several independent function: fixed and free end point problems	
3	**Calculus of variation II** Constrained extremum of functions: elimination method, Lagrange multiplier method Constrained extremum of functionals: point constraint, differential equation constraints, isoperimetric constraints. The Variational approach to optimal control problems: necessary conditions for optimal control for different boundary conditions	08
4	**Linear Regulator and Tacking Systems:** Linear Quadratic Regulator (LQR): Finite time LQR and infinite time LQR Linear Quadratic Tracking Systems: Finite and infinite time Cases	06
5	**Discrete time Optimal control systems**: variational calculus for discrete time systems, Discrete time LQR and tracking systems	05
6	**Dynamic Programming**: Principle of optimality, application of principle of optimality to decision making, dynamic programming applied to routing problem, Hamilton-Jacobi-Bellman (HJB) equation, LQR system using HJB equation	08
	Total	**39**

Text Books:

1	D. S. Naidu, *Optimal Control System*, CRC Press LLC - 2003,
2	D. E. Kirk, *Optimal Control Theory - An Introduction*, Dover Publication, New York –1998

References:

1	B.D.O. Anderson and J.B. Moore. *Optimal Control, Linear Quadratic Methods*. Prentice- Hall Inc., Englewood Cliffs, NJ, 1989.

2	H. Kwakernaak and R. Sivan. *Linear Optimal Control Systems*. Wiley-Inter science, New York, 1972.
3	A. Sage. *Optimum systems control*. Prentice Hall, 2nd edition, 1977
4	F. L. Lewis and V. L. Syrmos. *Optimal Control theory*. Wiley Inter science, 2nd edition, 1995.
5	R. D. Robinett, D. G. Wilson, G. R. Eisler, and J. E. Hurtado. *Applied dynamic programming for optimization of dynamical systems*. Advances in Design and Control. SIAM, Philadelphia, 2005.
6	K. Ogata, Discrete Time Control System, Second Edition, PHI, Inc. 1995.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8021	Project Management (abbreviated as PM)	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*					

IOC8021	**Project Management (abbreviated as PM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8021	**Project Management (abbreviated as PM)**	**3**

	Course Objectives:
1	To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2	To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure

Course Outcomes:	
The students will be able to	
1.	Apply selection criteria and select an appropriate project from different options.
2	Write work break down structure for a project and develop a schedule based on it.
3.	Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4.	Use Earned value technique and determine & predict status of the project.
5.	Capture lessons learned during project phases and document them for future reference

Module	**Detailed Content**	**No. of Hours**
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager.	5

	Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	
2	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6
3	**Project Planning and Scheduling:** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to Project Management Information System (PMIS).	8
4	**Projects:** Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	6
5	**Executing Projects:** Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. **Monitoring and Controlling Projects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. **Project Contracting** Project procurement management, contracting and outsourcing,	8
6	**Project Leadership and Ethics:** Introduction to project leadership, ethics in projects. Multicultural and virtual projects. **Closing the Project:** Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6
	Total	**39**

References:	
1	Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7th Ed.
2	A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3	Gido Clements, Project Management, Cengage Learning.
4	Gopalan, Project Management, , Wiley India
5	Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8022	Finance Management (abbreviated as FM)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem Exam	Exam Dur (Hrs)			

		Mid Test (MT)	**CA***					
IOC8022	**Finance Management (abbreviated as FM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8022	**Finance Management (abbreviated as FM)**	**3**

	Course Objectives:
1	Overview of Indian financial system, instruments and market
2	Basic concepts of value of money, returns and risks, corporate finance, working capital and its management
3	Knowledge about sources of finance, capital structure, dividend policy

Course Outcomes:	
The students will be able to	
1.	Understand Indian finance system and corporate finance
2.	Take investment, finance as well as dividend decisions

Module	Detailed Content	No. of Hours
1	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	09
2	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	10
3	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	10
4	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion— Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity‘s Working Capital Needs; Estimation of Working	10

	Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	
	Total	**39**

References:

1	Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2	Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3	Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4	Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8023	Entrepreneurship Development and Management (abbreviated as EDM)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem Ex	Ex Dur (Hr			

				am	s)			
		Mid Test (MT)	**CA***					
IOC 8023	**Entrepreneurship Development and Management (abbreviated as EDM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8023	**Entrepreneurship Development and Management (abbreviated as EDM)**	**3**

Course Objectives:	
1	To acquaint with entrepreneurship and management of business
2	Understand Indian environment for entrepreneurship
3	Idea of EDP, MSME

Course Outcomes:	
The students will be able to	
	Understand the concept of business plan and ownerships
	Interpret key regulations and legal aspects of entrepreneurship in India
	Understand government policies for entrepreneurs

Module	**Detailed Content**	**No. of Hours**
1	**Overview Of Entrepreneurship:** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	4
2	**Business Plans and Importance Of Capital To Entrepreneurship:** Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur **Entrepreneurship And Business Development:** Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	9
3	Women ‘s Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	5
4	**Indian Environment for Entrepreneurship:** key regulations and legal aspects, MSMED Act 2006 and its implications, schemes and policies of the	8

	Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	
5	**Effective Management of Business:** Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e- Marketing	8
6	**Achieving Success In The Small Business:** Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	5
	Total	**39**

References:

1	Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2	Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3	Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4	Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5	Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6	Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7	Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad

8	Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9	Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10	Laghu Udyog Samachar
11	www.msme.gov.in
12	www.dcmesme.gov.in
13	www.msmetraining.gov.in

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8024	Human Resource Management (abbreviated as HRM)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			TermWork	Pract &oral	Total
		Internal Assessment	End Sem Ex	Ex Dur (Hr			

				am	s)			
		Mid Test (MT)	**CA***					
IOC8024	**Human Resource Management (abbreviated as HRM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8024	**Human Resource Management (abbreviated as HRM)**	**3**

	Course Objectives:
1	To introduce the students with basic concepts, techniques and practices of the human resource management.
2	To provide opportunity of learning Human resource Management (HRM) processes, related with the functions, and challenges in the emerging perspective.
3	To familiarize the students about the latest developments, trends & different aspects of HRM.
4	To acquaint the student with the importance of behavioral skills, Inter- personal, inter- group in an organizational setting.

5	To prepare the students as future organizational change facilitators, stable leaders and managers, using the knowledge and techniques of human resource management.

Course Outcomes:	
Learner will be able to	
1.	Gain knowledge and understand the concepts about the different aspects of the human resource management.
2.	Understand and tackle the changes and challenges in today‘s diverse, dynamic organizational setting and culture.
3.	Utilize the behavioral skill sets learnt, in working with different people, teams & groups within the national and global environment.
4.	Apply the acquired techniques, knowledge and integrate it within the engineering/ non engineering working environment emerging as future engineers and managers.

Module	**Detailed Content**	**No. of Hours**
1	**Introduction to HR:** Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.	05
2	**Organizational Behavior (OB) :** Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues, Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness, Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behavior. Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor); Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. Case study	07

3	**Organizational Structure & Design:** Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	06
4	**Human resource Planning:** Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale. Performance Appraisal Systems: Traditional & modern methods, Performance Counseling, Career Planning. Training & Development: Identification of Training Needs, Training Methods	05
5	**Emerging Trends in HR :** Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes & transformation in HR. Organizational Change, Culture, Environment, Cross Cultural Leadership and Decision Making**:** Cross Cultural Communication and diversity at work**,** Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.	06
6	**HR & MIS:** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws & Industrial Relations** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	10
	Total	**39**

References:	
1	Stephen Robbins, Organizational Behavior, 16
2	V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3	Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4	C. B. Mamoria and S V Gankar,
5	P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013,
6	Himalaya Publishing

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8025	Professional Ethics and Corporate Social Responsibility (abbreviated as PECSR)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem Ex	Ex Dur (Hrs)			

				am				
		Mid Test (MT)	**CA***					
IOC 8025	**Professional Ethics and Corporate Social Responsibility (abbreviated as PECSR)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8025	**Professional Ethics and Corporate Social Responsibility (abbreviated as PECSR)**	**3**

Course Objectives:	
1	To understand professional ethics in business
2	To recognized corporate social responsibility

Course Outcomes:	
The students will be able to	
1.	Understand rights and duties of business
2.	Distinguish different aspects of corporate social responsibility
3.	Demonstrate professional ethics
4.	Understand legal aspects of corporate social responsibility

Module	**Detailed Content**	**No. of Hours**
1	**Professional Ethics and Business:** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
2	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **Professional Ethics and the Environment:** Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
3	**Professional Ethics of Consumer Protection:** Markets and Consumer Protection; Contract View of Business Firm‘s Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy **Professional Ethics of Job Discrimination:** Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06
4	**Introduction to Corporate Social Responsibility:** Potential Business Benefits— Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	05

5	**Corporate Social Responsibility:** Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08
6	**Corporate Social Responsibility in Globalizing India:** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility— Companies Act, 2013.	08
	Total	**39**

References:

1	Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2	Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3	Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4	Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8026	Research Methodology (abbreviated as RM)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem Ex	Ex Dur (Hr			

				am	s)			
		MidTest (MT)	**CA***					
IOC8026	**Research Methodology (abbreviated as RM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8026	**Research Methodology (abbreviated as RM)**	**3**

	Course Objectives:
1	To understand Research and Research Process
2	To acquaint students with identifying problems for research and develop research strategies
3	To familiarize students with the techniques of data collection, analysis of data and

Course Outcomes:	
The students will be able to	
1.	Prepare a preliminary research design for projects in their subject matter areas

2.	Accurately collect, analyze and report data
3.	Present complex data or situations clearly
4.	Review and analyze research findings

Module	Detailed Content	No. of Hours
1	**Introduction and Basic Research Concepts:** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research, **Issues** and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	10
2	**Types of Research:** Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	07
3	**Research Design and Sample Design:** Research Design – Meaning, Types and Significance, Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	07
4	**Research Methodology:** Meaning of Research Methodology, Stages in Scientific Research Process a. Identification and Selection of Research Problem b. Formulation of Research Problem c. Review of Literature d. Formulation of Hypothesis e. Formulation of research Design f. Sample Design g. Data Collection **h.** Data Analysis **i.** Hypothesis testing and Interpretation of Data h. Preparation of Research Report	07

5	**Formulating Research Problem:** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	04
6	**Outcome of Research:** Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	04
	Total	**39**

References:

1	Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2	Kothari, C.R., 1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3	Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2^{nd}e), Singapore, Pearson Education

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8027	IPR and Patenting (abbreviated as IPRP)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			TermWork	Pract &oral	Total
		Internal Assessment	End Sem Ex	Ex Dur (H			

				am	rs)			
		Mid Test (MT)	**CA***					
IOC 8027	**IPR and Patenting (abbreviated as IPRP)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8027	**IPR and Patenting (abbreviated as IPRP)**	**3**

Course Objectives:	
1	To understand intellectual property rights protection system
2	To promote the knowledge of Intellectual Property Laws of India as well as international treaty procedures
3	To get acquaintance with Patent search and patent filing procedure and applications

Course Outcomes:	
The students will be able to	
1.	understand Intellectual Property assets

2.	assist individuals and organizations in capacity building
3.	work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Module	Detailed Content	No. of Hours
1	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	05
2	**Enforcement of Intellectual Property Rights:** Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, international agreements, International organizations (e.g. WIPO, WTO) activein IPR enforcement **Indian Scenario of IPR:** Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	07
3	**Emerging Issues in IPR:** Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	06
4	**Basics of Patents:** Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	07
5	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08

6	**Procedure for Filing a Patent (National and International):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication etc, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	06
	Total	**39**

References:

1	Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2	Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3	T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4	Tzen Wong and Graham Dutfield,2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5	Cornish, William Rodolph &Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell
6	Lous Harns, 2012, The enforcement of Intellectual Property Rights: A Case Book, 3rd Edition, WIPO
7	Prabhuddha Ganguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8	R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books

9	M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications
10	Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications
11	Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
12	Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company
13	N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi**,** IPR: Drafting, Interpretation of Patent Specifications and Claims**,** New India Publishing Agency

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8028	Digital Business Management (abbreviated as DBM)	3	--	3	--		3

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem	Ex Dur			

				Exam	(Hrs)			
		Mid Test (MT)	**CA***					
IOC8028	**Digital Business Management (abbreviated as DBM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8028	**Digital Business Management (abbreviated as DBM)**	**3**

	Course Objectives:
1	To familiarize with digital business concept
2	To acquaint with E-commerce
3	To give insights into E-business and its strategies

Course Outcomes:
The students will be able to

1.	Identify drivers of digital business
2.	Illustrate various approaches and techniques for E-business and management
3.	Prepare E-business plan

Module	Detailed Content	No. of Hours
1	**Introduction to Digital Business:** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business**- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things (digitally intelligent machines/services) Opportunities and Challenges in Digital Business,	09
2	**Overview of E-Commerce: E-Commerce**- Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E- government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC pro ject, Legal, Ethics and Societal impacts of EC	06
3	**Digital Business Support services**: ERP as e –business backbone, knowledge Tope Apps, Information and referral system, **Application Development:** Building Digital business Applications and Infrastructure	06
4	**Managing E-Business**-Managing Knowledge, Management skills for e- business, Managing Risks in e –business, Security Threats to	06

	e- business -Security Overview, Electronic Commerce Threats, Encryption, ryptography,	
5	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	**M Materializing e-business: From Idea to Realization**-Business plan preparation	08
	Total	**39**

References:

1	A textbook on E-commerce**,** Er Arunrajan Mishra, Dr W K Sarwade,Neha Publishers & Distributors, 2011
2	E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3	Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4	Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
5	Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6	Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
7	Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan

8	E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
9	Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
10	Measuring Digital Economy-A new perspective -DOI:10.1787/9789264221796-en OECD Publishing

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)	10 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 needs to be solved.

Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
IOC8029	Environmental Management (abbreviated as EVM)	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***					
IOC8029	**Environmental Management (abbreviated as EVM)**	20	20	60	2	--	--	100

Course Code:	**Course Title**	**Credit**
IOC8029	**Environmental Management (abbreviated as EVM)**	**3**

Course Objectives:	
1	Understand and identify environmental issues relevant to India and global concerns
2	Learn concepts of ecology
3	Familiarize environment related legislation

Course Outcomes:	
The students will be able to	
1.	Understand the concept of environmental management
2.	Understand ecosystem and interdependence, food chain etc.

3.	Understand and interpret environment related legislations

Module	Detailed Content	No. of Hours
1	Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities. Environmental issues relevant to India, Sustainable Development, The Energy scenario.	10
2	Global Environmental concerns: Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	06
3	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	05
4	Scope of Environment Management, Role & functions of Government as a planning and regulating agency. Environment Quality Management and Corporate Environmental Responsibility	10
5	Total Quality Environmental Management, ISO-14000, EMS certification.	05
6	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	03
	Total	**39**

References:	
1	Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999

2	A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3	Environmental Management, T V Ramachandra and Vijay Kulkarni, TERI Press
4	Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5	Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Maclillan India, 2000
6	Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

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)	10 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 needs to be solved.

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL801	Instrument and System Design- 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 T	CA*					

		est (MT)						
ISL801	**Instrument and System Design- Lab**	--	--	--	--	25	25	50

Course Code:	**Course Title**	**Credit**
ISL801	**Instrument and System Design- Lab**	**1**

Course Objectives:	
1	To impart knowledge of selection and design considerations of transducers along with its calibration techniques.
2	To make the students capable of sizing the control valve.
3	To give the students' knowledge about the types, sizing of control panels and standards.
4	To make the students capable to apply knowledge to design electronic product, control room layout and its environment.
5	To give the students a comprehension of the aspects of reliability engineering.

Course Outcomes:	
The students will be able to	
1.	Calculate performance characteristics of a given transducer and calibrate transducers.
2.	Select and size the control valves and actuators.
3.	Estimate valve noise and predict cavitation.

4.	Apply knowledge to design the control panels and control room.
5.	Design electronic products and enclosures.
6.	Calculate Reliability engineering terms

List of Laboratory Experiments/ Assignments:	
Module	**Detailed Content**
1	To study the performance characteristics of transducer/ instrument
2	To calibrate temperature, flow, pressure or level transducers
3	To calculate Cv of a given valve (use Cv characteristic set up)
4	To design the control panel for any one application.
5	To design the layout of a control room.
6	Assignment on design of transducers.
7	Assignment on valve sizing for liquid services and gas/vapors.
8	Assignment on valve sizing for flashing, and mixed flow services
9	Assignment on estimation of control valve Noise and Cavitation
10	Assignment: examples on actuator sizing
11	Assignment on control panel design
12	Assignment on electronic product design and enclosure design

13	Assignment on reliability engineering.
14	Assignment on control room design and its environment

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 **ISC801**

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL8021	Digital Control System- 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 Te	CA*					

		st (MT)						
ISL 8021	**Digital Control System- Lab**	--	--	--	--	25	25	50

Course Code:	**Course Title**	**Credit**
ISL8021	**Digital Control System- Lab**	**1**

Course Objectives:	
1	The students should be able to determine response of ZOH and FOH
2	The students should be able to discretize continuous data system.
3	The students will be able to represent given system into different canonical form.
4	The students should able to determine state transition matrix
5	. Students can be able to design controller and observer

Course Outcomes:	
The students will be able to	
1	Compare the response with reconstruction due to ZOH and FOH.
2	Discretize the analog systems and signals with different methods
3	Verify the controllability and observability of systems
4	Demonstrate their knowledge to obtain different canonical forms analytically and verify using simulation software.

5	Determine state transition matrix using simulation software and verify the results analytically
6	Design controller and observer for the given system

List of Laboratory Experiments/ Assignments:	
Module	**Detailed Content**
1	To determine response of zero order hold and first order hold using simulation software
2	Mapping from S- plane to Z-plane analytically and verification using simulation software
3	Discretization of continuous data system using i) Step invariance method, ii) Impulse invariance method, and iii) Bilinear transformations, analytically and verification using simulation software
4	To check controllability and observability of a given system analytically and verify the result using simulation software.
5	To represent given system in different canonical forms, analytically and verification using simulation software
6	To determine pulse transfer function of a given system analytically and its verification using simulation software
7	Determination of state transition matrix analytically and its verification using simulation software
8	To design the controller by any method
9	To design an observer by any method

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 **ISDOC8011**

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL8022	Expert System- Lab	--	2	--	1		1

Course Code:	Course Title	Credit
ISL8022	Expert System- Lab	

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem	Ex Dur (Hrs)			

				Exam				
		Mid Test (MT)	**CA***					
ISL8022	**Expert System-Lab**	--	--	--	--	25	25	50

Course Objectives:	
1	To provide an understanding on the fundamentals of Artificial Intelligence and Expert System.
2	To provide an understanding on the fundamentals of neural network.
3	To provide an understanding on the fundamentals of fuzzy systems.
4	To provide an understanding of Neuro fuzzy system.
5	To provide an understanding of applications based on Artificial Intelligence and Expert System.

Course Outcomes:	
The students will be able to	
1.	Develop programs for various neural networks.
2.	Write program for advance neural networks.

3.	Simulate fuzzy inference system.
4.	Develop programs for neuro fuzzy systems.
5.	Demonstrate working of AI/Expert systems in Process control, Electrical Engineering.
6.	Demonstrate working of AI/Expert systems in Speech processing, medical diagnosis.

List of Laboratory Experiments/ Assignments:

Module	Detailed Content
1.	Write a python program to construct and simulate single input neurons. Simulate with different weights, transfer functions, etc.
2.	Write a python program to construct and simulate multi-input neurons. Simulate with different weights, transfer functions, etc.
3.	Write a python program for back propagation algorithm.
4.	Write a python program to simulate recurrent neural network.
5.	Write a python program to simulate convolutional neural network.
6.	Write a python program to simulate mamdani fuzzy inference system.
7.	Write a python program to simulate sugeno fuzzy inference system.
8.	Write a python program to simulate neuro fuzzy systems.
9.	Case study or mini project on application of AI/Expert systems in Process control.
10.	Case study or mini project on application of AI/Expert systems in Electrical Engineering.
11.	Case study or mini project on application of AI/Expert systems in Speech processing.
12.	Case study or mini project on application of AI/Expert systems in medical diagnosis.

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 **ISDOC8012**

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL8023	Digital Image 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*					

ISL8023	**Digital Image Processing Lab**	--	--	--	--	25	25	50

Course Code:	**Course Title**	**Credit**
ISL8023	**Digital Image Processing Lab**	**1**

Course Objectives:	
1	To introduce the basic elements of digital image processing.
2	To familiarize with 2-D Transforms of digital images.
3	Ability to use image enhancement and segmentation techniques.
4	To analyze image compression and object recognition algorithms.

Course Outcomes:	
The students will be able to:	
1.	Interpret the basic elements of digital image processing.
2.	Analyze digital images using 2-D transforms.
3.	Apply spatial filtering and image enhancement techniques in the frequency domain.
4.	Analyze image segmentation techniques.
5.	Apply different image compression techniques.
6.	Recognize and classify objects and patterns in digital images

List of Laboratory Experiments/ Assignments:	
Module	**Detailed Content**
1.	To perform basic operations on images.
2.	To perform conversion between color spaces.
3.	To perform 2D DFT/ DCT of images
4.	To perform histogram equalization.
5.	To perform image filtering in spatial domain
6.	To perform image filtering in frequency domain.
7.	To perform edge detection using various masks
8.	To perform global and adaptive thresholding
9.	To perform image compression using DCT / Wavelet transform.
10	To apply morphological operators on an image

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 **ISDOC8013**

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL8024	Internet of Things- 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*					

ISL8024	**Internet of Things- Lab**	--	--	--	--	25	25	50

Course Code:	**Course Title**	**Credit**
ISL8024	**Internet of Things- Lab**	**1**

Course Objectives:

1	To impart knowledge about fundamentals of IoT
2	To describe data and knowledge management and use of devices in IoT technology.
3	To give knowledge of IoT architecture and Integration of embedded devices with IoT
4	To explain the concept of IIoT.
5	To impart knowledge about designing of industrial internet systems.
	To describe overview of Android/ IOS app development tools and Internet of Everything

Course Outcomes:

The students will be able to

1.	Describe Fundamentals of IoT and make use of microcontroller based embedded platforms in IOT.
2.	Identify IoT enabling technologies and make use of microprocessor based embedded platforms in IOT.
3.	Apply wireless technology for exchange of data.
4.	Make use of Cloud platform to upload and analyse any sensor data and understand communication protocols used in IoT.
5.	Use of Devices, Gateways and Data Management in IoT.
6.	Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.

List of Laboratory Experiments/ Assignments:	
Module	**Detailed Content**
1	Assignment on Fundamentals and overview of IoT
2	Assignment on IoT enabling technologies
3	Introduction to Arduino platform and programming
4	Interfacing LDR sensor and LED with Arduino
5	Interfacing accelerometer sensor with Arduino
6	Interfacing gyroscope sensor with Arduino
7	Interfacing Arduino to Zigbee module
8	Interfacing Arduino to GSM module
9	Interfacing Arduino to Bluetooth Module
10	Assignment on communication protocols in IoT
11	Introduction to Raspberry PI platform and python programming
12	Interfacing sensors to Raspberry PI
13	Setup a cloud platform to log the data

14	Log Data using Raspberry PI and upload to the cloud platform
15	Design an IOT based system

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 **ISDOC8014**

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISL8025	Advanced Biomedical Instrumentation Lab	--	2	--	1		1

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Pract & oral	Total
		Internal Assessment	End Sem Exam	Exam Dur (Hrs)			

		Mid Test (MT)	**CA***					
ISL8025	**Advanced Biomedical Instrumentation Lab**	--	--	--	--	25	25	50

Course Code:	**Course Title**	**Credit**
ISL8025	**Advanced Biomedical Instrumentation Lab**	**1**

Course Objectives:	
1	To make students perform experiments based on the principle and working of various Biomedical Instruments used for Bio-potential measurements
2	To develop skills in the design of various biomedical instruments used in diagnosis and life-support.

Course Outcomes:	
The students will be able to	
1.	Design ECG, EEG, EMG amplifier.
2.	Design and/ or simulate prosthetic devices circuitry.
3.	Design circuitry required for patient monitoring systems and telemetry
4.	Distinguish between the various medical imaging techniques by comparing, principle and concept involved in each of the technique

5.	Use fiber optics for healthcare application.
6.	Describe the significance of electrical safety in biomedical measurement.

List of Laboratory Experiments/ Assignments:	
Module	**Detailed Content**
1.	Design and implement ECG amplifier circuitry.
2.	Design and implement EEG amplifier circuitry.
3.	Design and implement EMG Quantification circuit.
4.	Design asynchronous pacemaker circuit using op-amp or 555 timer.
5.	Simulate Hemodialysis machine.
6.	Design the multiplexing circuitry for a bedside monitor.
7.	Design and / or simulate central nurse station.
8.	Design and/or simulate ECG/EMG telemetry system
9.	Assignment on image reconstruction of CT.
10.	Distinguish imaging techniques such as MRI, PET and SPECT.
11.	Simulate characteristics of optical fiber.
12.	Study the characteristics of photo detectors.

13.	Assignment on Radiation safety or Electrical safety or Fire safety in biomedical.

Term Work:

Term work should consist of 08 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 **ISDOC8015**

Program Structure for Final Year

B.E Instrumentation Engineering

(With Effect from 2023-2024)

Scheme for Semester –VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Pract	Theory	Pract	Tut	Total
ISP801	Major Project – II	--	12#	--	6		6

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Ex Dur (Hrs)			
		Mid Test (MT)	CA*					
ISP 801	Major Project – II	--	--	--	--	100	50	150

Course Code:	Course Title	Credit
ISP801	**Major Project – II**	**6**

Course 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.

Course 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.	Analyze 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 Major Project:

- Students should form groups with minimum 2(two) and not more than 4 (four)
- Students should do survey and identify needs, which shall be converted into problem statement for major project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Student shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of major project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during major project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format of Department.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the major Projects.

Guidelines for Assessment of Major Project: Term Work

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of major project to be evaluated on continuous basis, minimum two reviews in the semester.
- 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.

Distribution of Term work marks for both semesters shall be as below

- Quality of Project report :30
- Marks awarded by review committee : 30
- Marks awarded by guide/supervisor based on log book : 40

Review/progress monitoring committee may consider following Points for assessment:

- In VIII semester expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.

  · First review is based on readiness of building working prototype to be conducted.

  · Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Assessment criteria of Major Project-II

Major Project-II shall be assessed based on following criteria;

1. Cost effectiveness and Societal impact
2. Full functioning of working model as per stated requirements
3. Effective use of skill sets
4. Effective use of standard engineering norms
5. Contribution of an individual's as member or leader
6. Clarity in written and oral communication

Guidelines for Assessment of Major Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Major Project shall be assessed through a presentation and demonstration of working 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.

- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Major 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 skill sets

6 Effective use of standard engineering norms

7 Contribution of an individuals as member or leader

8 Clarity in written and oral communication