



AISSMS **INSTITUTE OF INFORMATION TECHNOLOGY** **(IOIT)**



ADDING VALUE TO ENGINEERING

An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

ACADEMIC COURSE STRUCTURE

INSTRUMENTATION ENGINEERING

B.TECH 4 YEAR UG COURSE

(Applicable for the batches admitted from 2022-23)

AISSMS INSTITUTE OF INFORMATION TECHNOLOGY
Kennedy Road,
Near RTO, Pune-411001, Maharashtra State, India
Email: principal@aissmsioit.org,
Website: <https://www.aissmsioit.org>

Institute Vision & Mission

Vision:

To be recognized amongst top 10 private engineering colleges in Maharashtra by the year 2026 by rendering value added education through academic excellence, research, entrepreneurial attitude, and global exposure.

Mission :

- To enable placement of 150 plus students in the 7 lacs plus category & ensure 100% placement of all final year students.
- To connect with 10 plus international universities, professional bodies, and organizations to provide global exposure students
- To create conducive environment for career growth, prosperity, and happiness of 100% staff.
- To be amongst top 5 private colleges in Pune in terms of admission cut off

Quality Policy

We commit ourselves to provide quality education & enhance our students quality through continuous improvement in our teaching and learning processes.

Department Vision & Mission

Vision:

To be recognized as one of the best instrumentation engineering programs by developing globally competent engineers, researchers and entrepreneurs to solve real life problems through skill-based education.

Mission:

M1: To promote learning for skill-based education and emerging technologies to make students globally competent.

M2: To create conducive environment for research, innovations and entrepreneurship.

Program Educational Objectives:

Graduates will

1. solve real life problems by applying the knowledge of instrumentation technology.
2. pursue higher education or be researcher or be entrepreneur.
3. contribute as a socially responsible citizen for the development of nation.

Program Outcomes (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. [Engineering knowledge]
2. Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [Problem analysis]
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. [Design/development of solutions]
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. [Conduct investigations of complex problems]
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. [Modern tool usage]
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. [The engineer and society]
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. [Environment and sustainability]
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [Ethics]
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [Individual and team work]
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. [Communication]
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. [Project management and finance]
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. [Life-long learning]

Program Specific Outcomes(PSOs)

1. Graduates will be able to apply their knowledge of measurement and control to solve the problems related to environment, safety, health and agriculture sectors.
2. Graduates will be able to demonstrate their skills on Programmable logic controller, LabView, Distributed control system and Internet of thing.

Program–Instrumentation Engineering (Autonomous Curriculum Structure)

A. Definition of Credit

1Hr.Lecture(L)per week	1credit
1Hr.Tutorial(T)per week	1credit
1Hr.Practical(P)per week 2HoursPractical(Lab)/week	0.5 credits1 credit

B. Range of credits–

A range of Credits from 160 to 176 for a student to be eligible to get Undergraduate degree in Engineering. A student will be eligible to get Undergraduate degree with Honors or additional Minor Engineering if he/she completes an additional 20 Credits.

C. Credit for Under Graduate Degree in Instrumentation Engineering

Sr. No.	Year	Semester	Credits
1	First Year	I	21
2		II	19
3	Second Year	III	22
4		IV	24
5	Third Year	V	23
6		VI	25
7	Final Year	VII	12
8		VIII	14
Total Credits			160

D. Structure of Undergraduate Engineering program

Sr. no.	Domains	Code	Credits	NEP Suggested
1	Basic Science courses	BSC	16	14-18
2	Engineering Science courses	ESC	16	12-16
3	Programme Core Courses	PCC	60	44-56
4	Programme Elective courses	PEC	14	20
5	Open Elective other than particular Programme	OEC	06	08
6	Vocational and Skill Enhancement Course	VSE	08	08
7	Humanities Social Science and Management	HSM	12	14
8	Experiential Learning Courses	ELC	24	22
9	Liberal Learning Courses	LLC	04	04
Total			160	160-176

E. Domain wise Credit Distribution

Sr.no.	Code	Credits										
		Semesters								Total	NEP	
		I	II	III	IV	V	VI	VII	VIII			
1	BSC	8	8	-	-	-	-	-	-	-	16	14-18
2	ESC	9	7	-	-	-	-	-	-	-	16	12-16
3	PCC	-	-	16	15	13	12	4	-	-	60	44-56
4	PEC	-	-	-	-	4	4	6	-	-	14	20
5	OEC	-	-	3	-	3	-	-	-	-	06	08
6	VSE	1	1	-	3	-	3	-	-	-	08	08
7	HSM	-	-	3	3	3	3	-	-	-	12	14
8	ELC	3	3	-	1	-	1	2	14	-	24	22
9	LLC	-	-	-	2	-	2	-	-	-	04	04
Total Credits		21	19	22	24	23	25	12	14	-	160	160-176
Minor(Th+PR)		-	-	4	4	4	4	-	-	-	-	16
Total Credit including Minor		21	19	26	28	27	29	12	14	-	176	176
Exam Total		650	650	825	875	825	875	600	600	-	5900	-
Total Working Hrs. per Week		30	28	31	33	31	35	15	28	-	211	-

F. Honors Structure: Advanced Industrial Automation

Sr. No.	Course Code	Courses Name	Semester	Hrs. per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INHDT511	Smart Sensors	V	03	---	--	3	40#	60*	---	---	---	100
2	INHDT512	Smart Sensors Lab	V	--	--	02	1	--	--	--	--	25	25
3	INHDT613	Advanced Communication Techniques in Instrumentation	VI	03	---	--	3	40#	60*	---	---	---	100
4	INHDT614	Advanced Communication Techniques in Instrumentation Lab	VI	--	--	02	1	--	--	--	--	25	25
5	INHDT707	Cyber Security in Automation	VII	03	--	--	3	40#	60*	---	---	---	100
6	INHDT708	Cyber Security in Automation Lab	VII	--	01	02	2	--	--	25	25	--	50
7	INHDT803	Control Room and Data Centre	VIII	03	--	--	3	40#	60*	--	--	--	100
8	INHDT804	Control Room and Data Centre Lab	VIII	--	01	02	2	--	--	25	25	--	50
Total				12	02	08	18	160	240	50	50	50	550

G. Honors Degree-with Research

B.Tech (Honors with Research)													
Sr. No.	Course Code	Courses Name	Se m.	Hrs. per week			Cr ed it:	Examination Scheme:					Tota l
				L	T	P		ISE	ESE	TW	PR	OR	
1	IOHDR7R1	Research Methodology	VII	3	-	-	3	40#	60*	-	-	-	100
2	IOHDR7R2	Mathematical Modeling	VII	3	-	-	3	40#	60*	-	-	-	100
3	IOHDR7R3	Dissertation Phase 1	VII	-	-	4	2	-	-	25	--	25	50
4	IOHDR8R4	Paper Publication	VIII	2	-	-	2	-	-	50	-	-	50
5	IOHDR8R8	Research Publication and Ethics	VIII	-	-	4	2	-	50	--	-	-	50
6	IOHDR8R6	Dissertation Phase 2	VIII	-	-	12	6	-	-	100	-	50	150
Total				8	-	20	18	80	120	175	-	75	500

H. . Major Courses

Sr. No.	Code	Courses Name	Semester	Hours Per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INPCC302	Data Structure	III	03	---	---	03	40#	60**	---	---	---	100
2	INPCC303	Electrical Measurement And Instrumentation	III	03	---	---	03	40#	60**	---	---	---	100
3	INPCC304	Sensors and Transducers	III	03	---	---	03	40#	60*	---	---	---	100
4	INPCC305	Analog & Digital Techniques	III	03	--	---	03	40#	60*	---	---	---	100
5	INPCC307	Data Structure Lab	III	---	---	02	01	---	---	25	---	---	25
6	INPCC308	Electrical Measurement and Instrumentation Lab	III	--	--	02	01	--	--	--	--	25	25
7	INPCC309	Sensors and Transducers Lab	III	---	---	02	01	---	---	---	50	---	50
8	INPCC310	Analog & Digital Techniques Lab	III	---	---	02	01	---	---	--	50	--	50
9	INPCC402	Control System Components	IV	03	---	---	03	40#	60*	---	---	---	100
10	INPCC403	Operating System	IV	03	---	---	03	40#	60**	---	---	---	100
11	INPCC404	Process Control Loop Components	IV	03	---	---	03	40#	60*	---	---	---	100
12	INPCC405	Signal & Systems	IV	03	--	---	03	40#	60*	--	---	---	100
13	INPCC407	Virtual Instrumentation Lab	IV	---	---	02	01	---	---	25	---	---	25
14	INPCC408	Process Control Loop Components Lab	IV	---	---	02	01	---	---	---	50	---	50
15	INPCC409	PLC and SCADA Programming Lab	IV	--	---	02	01	---	---	25	---	--	25

16	INELC410	Project Based Learning Lab	IV	--	--	02	01	--	--	50	--	--	50
17	INLLC412	Lifelong Learning Skills-I	IV	--	--	--	01	--	--	25	--	--	25
18	INLLC413	Lifelong Learning Skills-II	IV	--	--	--	01	--	--	25	--	--	25
19	INPCC502	Industrial Automation	V	03	01	---	04	40#	60*	---	--	--	100
20	INPCC503	Embedded System Design	V	03	--	---	03	40#	60**	---	--	--	100
21	INPCC504	Digital Signal Processing	V	03	01	---	04	40#	60*	---	--	--	100
22	INPEC505	Professional Elective-I	V	03	---	--	03	40#	60*	---	--	--	100
23	INPCC507	Industrial Automation Lab	V	---	---	02	01	---	---	---	50	--	50
24	INPCC508	Embedded System Design Lab	V	--	---	02	01	---	---	50	--	--	50
25	INPEC509	Professional Elective-I Lab	V	---	---	02	01	---	---	--	--	50	50
26	INPCC602	Industrial Data Exchange	VI	03	01	---	04	40#	60*	---	--	--	100
27	INPCC603	Modern Control Theory	VI	03	---	---	03	40#	60*	---	--	--	100
28	INPCC604	Project Engineering And Management	VI	03	--	---	03	40#	60*	---	--	--	100
29	INPEC605	Professional Elective-II	VI	03	---	---	03	40#	60**	---	--	--	100
30	INPCC607	Project Engineering and Management Lab	VI	---	---	02	01	---	---	---	--	25	25
31	INPCC608	Modern Control Theory Lab	VI	---	---	02	01	---	---	---	50	--	50
32	INPEC609	Professional Elective-II Lab	VI	---	---	02	01	---	---	50	--	--	50
33	INELC610	Mini Project	VI	--	--	02	01	--	--	25	--	--	25
34	IOLLC6L3	Lifelong Learning Skills-III	VI	--	--	--	01	--	--	25	--	--	25
35	IOLLC6L4	Lifelong Learning Skills-IV	VI	--	--	--	01	--	--	25	--	--	25
36	INPCC701	Process Dynamics and Control	VII	03	---	--	03	40#	60*	---	--	--	100
37	INPEC702	Professional Elective-III	VII	03	---	---	03	40#	60*	---	--	--	100
38	INPEC703	Professional Elective-IV	VII	02	---	---	02	40#	60*	---	--	--	100
39	INPCC704	Process Dynamics and Control Lab	VII	---	---	02	01	---	---	25	--	50	75
40	INPEC705	Professional Elective-III Lab	VII	---	---	02	01	---	---	25	--	50	75
41	IOELC7P1	Project Stage-I	VII	---	---	04	02	---	---	100	--	50	150
42	INELC801	Internship	VIII	--	--	24	12	---	---	200	--	100	300
43	IOELC8P2	Project Stage-II	VIII	---	---	04	02	---	---	200	---	100	300
Total				69	03	56	96	760	1140	900	250	450	3500

I. Minor Courses (Minor in Instrumentation)

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INMNR301	Sensors and Transducers	III	03	---	---	03	--	75	--	--	--	75
2	INMNR302	Sensors and Transducers Lab	III	---	---	02	01	--	--	25	--	--	25
3	INMNR401	Process Control Loop Components	IV	03	---	--	03	--	75	--	--	--	75
4	INMNR402	Process Control Loop Components Lab	IV	---	---	02	01	--	--	25	--	--	25
5	INMNR501	Industrial Automation	V	03	--	--	03	--	75	--	--	--	75
6	INMNR502	Industrial Automation Lab	V	---	---	02	01	--	--	25	--	--	25
7	INMNR601	Project Engineering And Management	VI	03	--	--	03	--	75	--	--	--	75
8	INMNR602	Project Engineering And Management Lab	VI	---	---	02	01	--	--	25	--	--	25
Total				12	00	08	16	--	300	100	--	--	400

J. Open Elective Courses

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INOEC306	Control System	III	03	---	--	03	40\$	60\$	---	---	---	100
2	INOEC506	Automation In Production Systems and Management	V	03	---	--	03	40\$	60\$	---	---	---	100
Total				03	--	--	06	80	120	-	-	-	200

K. Vocational and Skill Enhancement Courses

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INVSE406	Industrial safety Engineering	IV	01	---	04	03	----	----	50	50	---	100
2	INVSE606	Process Instrumentation	VI	01	---	04	03	---	---	50	50	---	100
Total				02	-	08	06	---	---	100	100	----	200

L. Humanities Social Science and Management Course

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INHSM301	Democracy, Election & Governance@@	III	02	---	---	02	---	---	25	---	25	50
2	INHSM311	Audit Course Vedic Mathematics	III	01	--	--	01	--	--	25	--	--	25
3	INHSM401	Industrial Organization And Management@@	IV	02	---	---	02	---	---	25	---	25	50
4	INHSM411	Audit Course Sustainable Development Goals	IV	01	--	--	01	--	--	25	--	--	25
5	IOHSM501	Intellectual Property Rights@@	V	02	---	---	02	---	---	25	---	25	50
6	IOHSM5ACA	Audit Course 5-Foreign Language Level-1(German)	V	01	--	--	01	---	--	25	--	--	25
	IOHSM5ACB	Audit Course 5-Foreign Language Level-1(Japanese)											
7	IOHSM601	Seminar and Technical Paper Writing	VI	01	---	02	02	---	---	50	---	---	50
8	IOHSM6ACA	Audit course Foreign LanguageLevel-2 (Germa)	VI	01	--	--	01	--	--	25	--	--	25
	IOHSM6ACB	Audit course Foreign LanguageLevel-2 (Japanese)											
			Total	11	-	02	12	-	-	200	-	75	300

M. Experiential Learning Courses

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INELC410	Project Based Learning Lab	IV	--	--	02	01	--	--	50	--	--	50
2	INELC610	Mini Project	VI	--	--	02	01	--	--	25	--	--	25
3	IOELC7P1	Project Stage-I	VII	---	---	04	02	---	---	100	---	50	150
4	INELC801	Internship	VIII	--	--	24	12	---	---	200	---	100	300
5	IOELC802	Project Stage -II	VIII	---	---	04	02	---	---	200	---	100	300
			Total	-	-	36	18	-	-	575	-	250	825

N. Liberal Learning Courses

Sr. No.	Code	Courses Name	Semester	Hours per week			Credit	Examination Scheme					Total
				L	T	P		ISE	ESE	TW	PR	OR	
1	INLLC412	Lifelong Learning Skills-I	IV	--	--	--	01	--	--	25	--	-	25
-2	INLLC413	Lifelong Learning Skills-II	IV	--	--	--	01	--	--	25	--	-	25
3	IOLLC6L3	Lifelong Learning Skills-III	VI	--	--	--	01	--	--	25	--	-	25
4	IOLLC6L4	Lifelong Learning Skills-IV	VI	--	--	--	01	--	--	25	--	-	25
			Total	--	--	--	04	-	-	100	-	-	100

All the student are required to acquire 2credits,one each from A. And B. Which will have grades as below:

A. Extracurricular Activities:

Sr. No.	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Sports	Intercollegiate	Participation	P	Prizewinner	C
		University	Participation	C	Prizewinner	B
		Zonal	Participation	B	Prizewinner	B+
		State	Participation	B+	Prizewinner	A
		National	Participation	A	Prizewinner	A+
		International	Participation	A+	Prizewinner	O
2.	NSS/NCC	Camp	Attended	B		
		Camp+5Activities	Attended	B+		
		Camp+10Activities	Attended	A		
		Camp+15Activities	Attended	A+		
		Camp+20Activities	Attended	O		
3.	Cultural	Intercollegiate	Participation	B	Prizewinner	B+
		State	Participation	B+	Prizewinner	A
		National	Participation	A	Prizewinner	A+
		International	Participation	A+	Prizewinner	O
4.	Community Engagement	Certified by NGO/Authorities with report and geo-tagged photograph	1Activity	B		
			2Activities	B+		
			3Activities	A		
			4Activities	A+		
			5Activities	O		

B. Cocurricular Activities:

Sr. No	Activity	State	Participation	B+	Prizewinner	A
		National	Participation	A	Prizewinner	A+
		International	Participation	A+	Prizewinner	O
Sr. No	Activity	Level	Achievement	Grade	Achievement	Grade
1.	Conference	National	Participation	B	Prizewinner	A
		International	Participation	B+	Prizewinner	A+
		International (Scopus indexing)	Participation	A+	Prizewinner	O
2.	Journal Publication	Non-refereed but recognized and reputed journal/periodical, having ISSN number.		B		
		Refereed Journal –As listed by UGC		A		
		Refereed Journals-As listed by Scopus		A+		
		Refereed Journals – As listed by SCI/ SCIE		O		
3.	Hackathon		Participation	A+	Prizewinner	O
4.	Professional Body	National	Membership	P	3 rd Prize	A
			Activities/ participation	B	2 nd Prize	A+
			5participations	B+	1 st Prize	O
5.	Internship	1week	Completed	C		
		2week	Completed	B		
		3week	Completed	B+	Sponsored Project	A+
		4week	Completed	A	Job through internship	O
6.	Entrepreneurship	Awareness camp	Attended	A	Product Developed	A+
					Own Startup	O
7.	Project/ Technical events	Intercollegiate	Participation	P	Prizewinner	C
		University	Participation	C	Prizewinner	B
		Zonal	Participation	B	Prizewinner	B+

Any activity other than listed above but having equal weightage should be considered for getting additional credit. The marks with respect to grades are as follows:

Sr. No.	Grade	Marks
1.	O	25
2.	A+	22
3.	A	20
4.	B+	18
5.	B	16
6.	C	13
7.	P	10
8.	F	0-5

O. Exit Course

Sr. No.	Level	Code	Course Title	Hours per week			Credit	Examination Scheme					Total
				Lecture	Tutorial	Practical		ISE	ESE	TW	PR	OR	
Certificate course in Sensor Measurement System													
1	Exit course after F.Y	INEXC101	Sensors and Transducers Lab	---	---	04	02	--	--	50	--	---	50
2		INEXC102	Electrical Measurement and Instrumentation Lab	--	--	04	02	--	--	50	---	--	50
3		INEXC103	Internship	--	--	08	04	--	--	100	--	--	100
		Total				16	08	--	--	200	--	--	200
Diploma in Embedded Design													
4	Exit course after S.Y	INEXC201	Digital Signal Processing Lab	--	---	04	02	---	---	50	--	---	50
5		INEXC202	Embedded System Design Lab	--		04	02	-	-	50	--	-	50
6		INEXC203	Internship	--	--	08	04	--	--	100	--	--	100
		Total				16	08	--	--	200	--	--	200
Bsc Vocational in Industrial Automation													
7	Exit course after T.Y	INEXC301	Process Dynamics and Control Lab	--	--	04	02	--	--	50	--	-	50
8		INEXC302	Automotive Instrumentation Lab	--	--	04	02	--	--	50	--	--	50
9		INEXC303	Internship	--	--	08	04	--	--	100	--	--	100
10		Total		-	-	16	08	--	--	200	--	--	200

Instrumentation Engineering–Third Year(Semester–V)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	IOHSM501	Intellectual Property Rights @@	02	---	---	02	---	---	25	---	25	50
2	INPCC502	Industrial Automation	03	01	---	04	40#	60*	---	---	---	100
3	INPCC503	Embedded System Designs	03	---	---	03	40#	60**	---	---	---	100
4	INPCC504	Digital Signal Processing	03	01	---	04	40#	60*	---	---	--	100
5	INPEC505	Professional Elective-I	03	---	--	03	40#	60*	---	---	---	100
6	INOEC506	MOOC (Automation In Production Systems and Management)	03	---	--	03	40\$	60\$\$	---	---	---	100
7	INPCC507	Industrial Automation Lab	---	---	02	01	---	---	---	50	--	50
8	INPCC508	Embedded System Design Lab	--	---	02	01	---	---	50	--	---	50
9	INPEC509	Professional Elective–I Lab	---	---	02	01	---	---	--	---	50	50
10	IOHSM5ACA	Audit Course 5- Foreign Language Level-I(German)	01	--	--	01	---	--	25	--	--	25
	IOHSM5ACB	Audit Course 5- Foreign Language Level-I(Japanese)										
Total			18	02	06	23	200	300	100	50	75	725
11	INMNR501	Industrial Automation	03	--	--	03	---	75	---	--	--	75
12	INMNR502	Industrial Automation Lab	--	--	02	01	--	--	25	---	---	25
Grand Total			21	02	08	27	200	375	125	50	75	825

Professional Elective-I INPEC505		Professional Elective-I INPEC509	
INPEC505A	Data Science	INPEC509A	Data Science Lab
INPEC505B	Biomedical Instrumentation	INPEC509B	Biomedical Instrumentation Lab
INPEC505C	Web Technology	INPEC509C	Web Technology Lab

*	End Semester Examination (ESE) based on subjective questions.
**	Practical or Activity based Evaluation.
#	In Semester Evaluation 1 based on Subjective Examination.
	In Semester Evaluation 2 based on Presentation / Group Discussion / Laboratory Work / Course Project / Home Assignment / Comprehensive Viva Voce/ Blog Writing / Case Study / Survey / GATE based MCQ examination/ Numerical based Subjective Examination.
\$	For MOOCs: Assignments marks will be converted on the scale of 40 marks.
\$\$	For MOOCs: Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.
@@	To earn the credits, passing is mandatory in both the examination heads.

MOOC: Automation In Production Systems and Management https://onlinecourses.nptel.ac.in/noc24_mg117/preview

Instrumentation Engineering–Third Year(Semester–VI)

Sr. No.	Code	Course Title	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	INHSM601	Seminar and Technical Paper Writing	01	---	02	02	---	---	50	---	---	50
2	INPCC602	Industrial Data Exchange	03	01	---	04	40#	60*	---	---	---	100
3	INPCC603	Modern Control Theory	03	---	---	03	40#	60*	---	---	---	100
4	INPCC604	Project Engineering And Management	03	--	---	03	40#	60*	---	---	---	100
5	INPEC605	Professional Elective-II	03	---	---	03	40#	60**	---	---	---	100
6	INVSE606	Process Instrumentation @@	01	---	04	03	--	--	50	50	---	100
7	INPCC607	Project Engineering and Management Lab	---	---	02	01	---	---	---	--	25	25
8	INPCC608	Modern Control Theory Lab	---	---	02	01	---	---	---	50	---	50
9	INPEC609	Professional Elective-II Lab	---	---	02	01	---	---	50	--	--	50
10	INELC610	Mini Project	--	--	02	01	--	--	25	--	--	25
11	IOHSM6AC A	Audit course Foreign Language Level-2 (Germa)	01	--	--	01	--	--	25	--	--	25
	IOHSM6AC B	Audit course Foreign Language Level-2 (Japanese)										
12	IOLLC6L3	Lifelong Learning Skills-3	--	--	--	01	--	--	25	--	--	25
13	IOLLC6L4	Lifelong Learning Skills-4	--	--	--	01	--	--	25	--	--	25
Total			15	01	14	25	160	240	250	100	25	775
14	INMNR601	Project Engineering And Management	03	--	--	03	---	75	---	--	--	75
15	INMNR602	Project Engineering And Management Lab	--	--	02	01	--	--	25	---	---	25
			18	01	16	29	160	315	275	100	25	875

Professional Elective-II INPEC605		Professional Elective-II INPEC609	
INPEC605A	Machine Learning	INPEC609A	Machine Learning Lab
INPEC605B	Building Automation	INPEC609B	Building Automation Lab
INPEC605C	Robotics Automation	INPEC609C	Robotics Automation Lab

*	End Semester Examination (ESE) based on subjective questions.
**	Practical or Activity based Evaluation.
#	In Semester Evaluation 1 based on Subjective Examination.
	In Semester Evaluation 2 based on Presentation / Group Discussion / Laboratory Work / Course Project / Home Assignment / Comprehensive Viva Voce/ Blog Writing / Case Study / Survey / GATE based MCQ examination/ Numerical based Subjective Examination.
@@	To earn the credits, passing is mandatory in both the examination heads.
	Note: Students are required to undergo industrial internship of 4 weeks in summer vacation and submit report at the beginning of next year

Third Year Information Technology (2022 Course)			
Intellectual Property Rights			
Course Code:	IOHSM501	Credit:	2
Contact Hrs.:	2 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme:	Term-work 25 marks	Oral 25 marks	

Pre-requisites:

Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25
2.	Oral	External	25

Course Objectives

1	To explain the significance of Intellectual Property
2	To study various aspects of Patents
3	To understand the significance of patent information in Business development
4	To study patents documents and process for examination

Course Outcomes: Students will be able to

501.1	Describe the significance of intellectual property
501.2	Discuss various aspects of patents
501.3	Search patent information in database
501.4	Explain patents documents and process for examination
501.5	Describe concepts related to trademarks
501.6	Differentiate copyright from patent

Topics covered:

UNIT I: INTELLECTUAL PROPERTY RIGHTS(IPR) (4 Hrs.)

IPR-Meaning, Relevance, Business Impact, Types of Intellectual Property, Protection of Intellectual Property, Competing Rationales for Protection of Intellectual Property Rights, The World Intellectual Property Organization (WIPO) and the UNESCO.

UNIT II : PATENT (4 Hrs.)

Concept of Patent, Types of Product / Process Patents & Terminology, Duration of Patents- Law and Policy Consideration ,Elements of Patentability (Novelty and Non Obviousness /Inventive Steps , Industrial Application, Non- Patentable Subject Matter), Procedure for Filing of Patent Application and types of Applications.

UNIT III: PATENT DATABASES & PATENT INFORMATION SYSTEM (4 Hrs.)

Patent Offices in India, Importance of Patent Information in Business Development, Patent search through Internet, Patent Databases.

UNIT IV: PATENT DOCUMENTS & PROCESS FOR EXAMINATION (4 Hrs.)

Lab Notebooks/Logbooks/Record Books, Methods of Invention Disclosures, Patent Application and its Contents, Writing of the Patent Document, Publication of Patent Applications, Request for Examination, Process for Examination & Prosecution, Reissue & Re-examination.

UNIT V: TRADEMARKS (4 Hrs.)

Definition and concept of Trademarks, The rationale of protection of trademark, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) .

UNIT VI COPYRIGHTS (4 Hrs.)

Definition of Copyright, Nature of Copyright, Works in which Copyrights subsist, Author & Ownership of Copyright , Rights Conferred by Copyright , Registration of Copyrights & Appeals.

Syllabus contents required for competitive exams (GATE, UPSC, MPSC etc.)(if complete unit is applicable then write only "unit 1/2/.." or write the contents from that unit):

1. NA.

Text Books:

1. Intellectual Property Rights-Law and Practice By Laser Typesetting

Reference Books

1. Aswani Kumar Bansal, "Law of Trademarks in India" ,Commercial Law Publishers, 2001
2. B L Wadehra, "Law Relating to Patents, Trademarks, Copyright, Designs and Geographical Indications" Universal Law Publishing Co Ltd.
3. G.V.G Krishnamurthy , "The Law of Trademarks, Copyright, Patents and Design"
4. Satyawrat Ponkse, "The Management of Intellectual Property" Bhate&Ponkshe, 1991
5. S K Roy Chaudhary& H K Saharay , "The Law of Trademarks, Copyright, Patents and Design.Legal Aspects of Technology Transfer: A Conspectus"

E-Resources:

1. Patent act:
https://ipindia.gov.in/writereaddata/Portal/IPOAct/1_31_1_patent-act-1970-11march2015.pdf
2. Practice and procedures:
https://ipindia.gov.in/writereaddata/Portal/Images/pdf/Manual_for_Patent_Office_Practice_and_Procedure_.pdf

**Third Year Instrumentation Engineering
Industrial Automation**

Course Code:	INPCC502	Credit	04
Contact Hours:	3 Hrs/week (L) 1 Hr/week (T)	Type of Course:	Lecture & Tutorial
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Analog and Digital Techniques

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To introduce the basics of PLC, HMI, SCADA and DCS
2	To explain advanced PLC instructions and interfacing of analog and digital devices with PLC.
3	To explain the configuration, operation and programming of DCS.
4	To introduce advanced techniques like MES, ERP of industrial automation.

Course Outcomes: Students will be able to

502.1	Understand the fundamentals of PLC, PLC interfacing and HMI.
502.2	Develop SCADA system for given applications.
502.3	Describe the software and hardware DCS configuration.
502.4	Explain DCS operation and integration.
502.5	Develop FBD program for automation and explain advanced techniques in DCS.
502.6	Explain various DCS applications.

Topics covered:

Unit I: Introduction to Industrial Automation(07 hrs)

PLC: Architecture, programming, Applications

HMI: Need of HMI, Advantages of HMI

Interfacing: PLC interfacing to HMI, Drives, Actuators, Scanners, Printers, Robots

Unit II: Supervisory Control & Data Acquisition (SCADA) (06 hrs)

SCADA components, Applications and benefits, PLC vs RTU, Types of SCADA: Client server based, Stand alone, web based. Trending, Historical data storage & Reporting, Alarm management, Development of application using SCADA System.

Unit III: Introduction to Distributed Control System and its configuration (07 hrs)

Distributed Control System (DCS): Introduction, Functions, Architecture, system interfacing, Features, DCS Specification, Advantages, limitations

DCS Configuration: Structure and Configuration, redundancy concepts, Process variables, software variables, tags, Alarms, Trends, Databases. Basic DCS Controller Configuration, Function Blocks.

Comparison of DCS, PLC, and SCADA

Unit IV: DCS Operation (07 hrs)

DCS Operator Stations, Recorders, Loggers, Trend Displays, and Data Archiving, HMI in the Control Room and in the Field: Mobile and remote devices. Alarms philosophy, Control & Management. Development and Applications, Logs, trends, and reports.

DCS Operation, Operational view of DCS, Role of operators, Integration and Optimization of DCS.

Unit V: DCS Programming and advanced techniques (08 hrs)

DCS Programming Languages (IEC 61131-3): Function block diagram (FBD), Sequential Function Chart (SFC), Programming Algorithms for Modules.

Advanced techniques: Manufacturing Execution System (MES), Manufacturing Operations Management (MOM), Asset Performance Management (APM), Enterprise Resource Planning (ERP)

Unit VI: DCS Applications (06 hrs)

Applications: Use of DCS in pulp and paper environment, petroleum-refining environment and oil and gas processing environment. Cloud based application.

Text Books:

1. Programmable Logic Controllers: Principles & Applications by John W. Webb, Ronald A. Reis, Prentice Hall of India, 5th ed.
2. Introduction to Programmable Logic Controllers by Gary Dunning, Delmar Thomson Learning, 3rd ed.
3. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 1997.
4. Computer aided process control, S. K. Singh, PHI.

References Books:

1. Programmable Logic Controller by Frank D Petruzella, McGraw-Hill Education, 5th ed.
2. Programmable Logic Controllers by W. Bolton, Elsevier Newness publication, 4th ed.
3. Programmable Controller by T. A. Huges, ISA publication, 2nd ed.
4. SCADA by Stuart A. Boyer, ISA 1999.
5. Distributed computer control for industrial automation, Popovik, Bhatkar, Dekkar Pub.
6. Understanding Distributed Process Systems For Control, Samuel Herb, ISA.

Third Year Instrumentation Engineering Embedded System Design			
Course Code:	INPCC503	Credit	03
Contact Hours:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	Activity based

Pre-requisites: Digital Electronics, Basic Electronics Engineering, Operating System.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To study the architecture and instructions set in 8051 Microcontroller.
2	To write the codes in assembly and embedded C programming.
3	To interfacing the various I/O peripherals to the 8051 microcontroller.
4	To write codes in machine learning and embedded system
5	To study the implementation of embedded systems in advance tools.

Course Outcomes: Students will be able to

503.1	Explain the architecture of 8051 microcontroller.
503.2	Illustrate the execution of instructions in assembly and embedded c programming language.
503.3	Demonstrate the timers and serial communication programs.
503.4	Model the various interfacing peripherals to the 8051 microcontroller.
503.5	Develop a project based on Raspberry Pi Platform and Arduino.
503.6	Learn how to create a model in Matlab Simulink.

Topics covered:

Unit I: Introduction to Microcontroller 8051 (6 hrs.)

Architecture of Microcontroller 8051, General Purpose and Special Purpose Registers, Memory organization, Stack Operations, Addressing Modes, Interrupts.

Unit II: Instructions sets in Microcontroller 8051 (6 hrs)

Data Transfer, Arithmetic, Logical, Branching, Looping, Counting, Sorting, Indexing, Conditional programming, Assembler Directives, Machine Cycle.

Software development cycle: editor, assembler, cross-compiler, linker, compiler.

Unit III: Timers and serial communication

Programming on Timers & Counters, Pulse width modulation, Serial communication programming.

Unit IV: Interfacing I/O devices. (10 hrs)

Pushbutton, Matrix keypad, LED, 7-segment LED display, LCD displays. Interface Analog Devices: ADC, LM35, Thermocouple, DAC. Stepper motor and DC motor interfacing.

Unit V: Embedded Python Programming (6 hrs)

Embedded Device Interfacing with Python Programming Language on Raspberry Pi Platform and Arduino(LabView).

Unit VI: Simulink Embedded Coder (4hrs)

Selecting Targets, Optimizing and Packaging Code, Executing and Verifying Code.

Text Books:

1. The 8051 Microcontroller Architecture, Programming and Applications by Kenneth J. Ayala, Penram International Publications
2. “The 8051 Microcontroller and Embedded Systems – using assembly and C”, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
3. “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Raj Kamal, Pearson Education, 2005

References Books:

1. Embedded System Design – Frank Vahid, Tony Givargis, John Wiley. Y Daniel Liang, “
2. Programming and customizing the 8051 microcontroller, Predko Michael, McGrawHill, International ed

Third Year Instrumentation Engineering			
Digital Signal Processing			
Course Code:	INPCC504	Credit	04
Contact Hours:	3 Hrs/week (L) 1 Hr/week (T)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Signals & System, Engineering Mathematics.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To study the basics of signal processing.
2	To explain the various transforms for signal analysis.
3	To demonstrate interplay between time and frequency domain
4	To study the FIR and IIR filters.

Course Outcomes: Students will be able to

504.1	Classify the signals and systems.
504.2	Apply z transform for signal analysis in frequency domain.
504.3	Compute the response of discrete-time systems to various input signals
504.4	Analyze the frequency domain characteristics of Discrete-Time Systems
504.5	Design IIR filters from appropriate specifications.
504.5	Select the FIR filter design algorithm as per the filter specifications.

Topics covered:

Unit I: Introduction to Discrete Time Signals and Systems (6 hrs.)

Basic elements of Digital Signal Processing (DSP), analog to digital conversion (ADC), comparison between DSP and Analog Signal Processing (ASP) with applications of DSP. Discrete-time signals and systems: classification of signals, sampling theorem, classification of systems, input-output description of systems.

Unit II: Analysis of Discrete-Time Systems (6 hrs)

Linear convolution, causality and stability of discrete time systems, autocorrelation, cross correlation, Z-transform and its properties, transfer function, pole-zero plot. Implementation of discrete-time systems: Structures for the realization,

Unit III: Frequency analysis of Discrete-Time Signals (6)

Frequency response of LTI systems, Discrete-Time Fourier Series (DTFS) and Discrete Time Fourier Transform (DTFT) and , properties Energy density spectrum and power density spectrum

Unit IV: Fast Fourier Transform. (6 hrs)

Discrete Fourier transform (DFT), properties of DFT, circular convolution, linear filtering methods based on DFT, Fast Fourier Transform (FFT) algorithms: Radix-2 Decimation In-Time (DIT) and Decimation-In-Frequency (DIF) FFT algorithms.

Unit V: Design of IIR filters (6 hrs)

Introduction to analog IIR filters, Butterworth approximation, Chebyshev approximation. Design of digital IIR filter: impulse invariance method, bilinear transformation.

Unit VI: : Design of FIR filters (6 hrs)

Introduction to FIR filters, linear phase filters, symmetric and anti-symmetric filters, FIR design by Fourier approximation, window method, frequency sampling method, comparison between FIR and IIR filters.

Text Books:

1. Proakis J. G and D. G. Manolakis, "Digital Signal processing, Principles, Algorithms and Applications", Prentice Hall of India.
2. Johnson J. R, "Introduction to Digital Signal Processing", Prentice Hall of India.
E. C. Ifeachor & B. W. Jarvis,
3. "Digital Signal Processing- A Practical Approach", Pearson Education, New Delhi

References Books:

1. S. K. Mitra, "Digital Signal Processing: A Computer based Approach", Tata McGraw Hill
2. Oppenheim A. V and R. W. Schaffer, "Discrete Time Signal Processing", Pearson Education,

Third Year Instrumentation Engineering Data Science			
Course Code:	INPEC505A	Credit	03
Contact Hours:	03 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Data structure, linear algebra, statistics.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To describe data science processes, applications.
2	To explain statistical methods for data analysis.
3	To describe data science packages.
4	To demonstrate exploratory data analysis and data visualization.

Course Outcomes: Students will be able to

505A.1	Use data science processes.
505A.2	Demonstrate statistics for data analysis.
505A.3	Describe data science packages.
505A.4	Demonstrate data cleaning methods.
505A.5	Create data visualization desktop.

Topics covered:

Unit I: Introduction to Data Science (6 hrs)

Data science definition, Introduction to Artificial Intelligence, Machine Learning and Deep Learning. Data science process: Data science life cycle, Different steps, Data Science Software Tools, Programming Languages for Data Science, Applications of Data Science, Job roles in Data Science.

Unit II: Data Sampling and Statistics for Data Analysis (6 hrs)

Types of data, Data Collection and Sampling methods, Statistics: Descriptive Statistics: Measurement of central tendency (Mean, median and mode), measurement of spread (Range, IQR, variance, standard deviation) , correlation, covariance and Inferential Statistics (Probability, Hypothesis testing)

Unit III: Data Science Packages (6 hrs)

Numpy: Array Operation, Indexing/slicing, mathematical operations, Matrix operations, String operation. Pandas: Basic pandas operation on data frame, append, loc and iloc, missing values, merge, concat, control loops. Matplotlib: Histogram, Line chart, bar chart, pie chart, scatter plot, subplot, imshow. Seaborn, Sklearn: used for Machine learning. Scipy: used for scientific purpose.

Unit IV: Exploratory Data Analysis /Data Cleaning (6 hrs)

Identification of variables and data types, Univariate, bivariate, multivariate analysis, Missing value treatment (Mean /median/mode methods), Outlier treatment (Percentile, Std dev, IQR, Boxplot, Z score)

Unit V: Variable and Feature Transformation (6 hrs)

Categorical to Numerical: One hot encoding, dummies, Label encoding, Feature Selection, Feature Rescaling (Normalization and Standardization), Feature Transformation(Log, exponential, square)

Unit VI: Introduction to Data Visualization Tools: Power BI (6 hrs)

Introduction to Power BI, Understanding the Power BI ecosystem (Desktop, Service, Mobile), Features of Power BI, Power BI Desktop, importing data from different sources, Basic charts, Data visualization.

Text Books:

1. Python for data analysis by O'Reilly
2. Data Visualization in python by Daniel Nelson
3. Mastering Python for Data Science by Samir Madhavan
4. Introduction to Data Science by Iguar, Segui, Springer, 2017

References Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing, and Presenting Data by John Wiley & Sons
2. Python for Data Analysis by W McKinney
3. Think Stats: Probability and Statistics for Programmers by Allen B. Downey
4. Elements of Statistical Learning by Hastie, Tibshirani, Friedman, Springer, 2011
5. The art of Data Science by Matsui, Peng, 2016
6. Data Science from Scratch by Grus, Google Books, 2015

E- Books / E- Learning References:

Python for data science: <https://nptel.ac.in/courses/106106212>

Third Year Instrumentation Engineering Biomedical Instrumentation			
Course Code:	INPCC505B	Credit	03
Contact Hours:	2 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Digital Electronics, Basic Electronics Engineering, Operating System.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To understand the anatomy of various systems in human body.
2	To learn the all types of Bio electrodes and measurement techniques
3	To acquire the skill to handling the biomedical equipment's.
4	To understand the component and working of biomedical equipments

Course Outcomes: Students will be able to

505B.1	To understand the anatomy of various systems in human body.
505B.2	Select and apply the appropriate bioelectrode for measurement of physiological parameters.
505B.3	Demonstrate his/her skills by using biomedical equipment's.
505B.4	Explain the function of instruments and its working
505B.5	Learn upcoming technology through continuous learning in biomedical instrumentation field.

Topics covered:

Unit I: Bio-potential Measurement: (07 hrs)

Electrode-Electrolyte interface, half-cell potential, Polarization- polarisable and nonpolarizable electrodes, Ag/AgCl electrodes, Electrode circuit model; motion artifact. Body Surface recording electrodes for ECG, EMG, and EEG. Internal electrodes- needle and wire electrodes. Micro electrodes- metal microelectrodes, Electrical properties of microelectrodes. Electrodes for electric stimulation of tissue Bio-transducers: Physiological parameters & suitable transducers for its measurements, operating principles & specifications for the transducers to measure parameters

Unit II: Cardiovascular System: (07 hrs)

Heart Structure, Cardiac Cycle, ECG Theory, ECG Electrodes, Electrocardiograph, Vector cardiograph Analog Signal Processing of Bio-signals, Amplifiers, Transient Protection, Interference Reduction, Movement Artifact Circuits, Active Filters, Rate Measurement, Averaging and Integrator Circuits, Transient Protection Circuits

Unit III: Cardiovascular Measurements: (07 hrs)

Heart Sounds, Phonocardiography, Blood Pressure Measurement (Invasive and Noninvasive), Blood Flow meters: Magnetic, Ultrasonic, Thermal Convection Methods, Cardiac Output Measurement (dye dilution method), Plethysmography

Unit IV: Central Nervous System : (07 hrs)

Brain & its parts, different waves from different parts of the brain, brain stem, cranium nerves, structure of neuron, Neuro muscular transmission, Electroencephalography, Evoked Response, EEG amplifier, Biofeedback Classification of muscles: Muscle contraction mechanism, Myoelectric voltages, Electromyography (EMG).

Unit V: Special Senses: (06 hrs)

I Ear: Mechanism of Hearing, Sound Conduction System, Basic Audiometer; Pure tone audiometer; Audiometer system Bekesy; Evoked response Audiometer system, Hearing Aids II Vision: Anatomy of Eye, Visual acuity, (Errors in Vision,)

Unit VI: Respiratory Instrumentation: (06 hrs)

Natural Process of Breathing, O₂ and CO₂ Transport, Regulation of Breathing, Spirometers, airflow measurement, Oxygenators-Bubble Type, Membrane Type Gas Analyze

Text Books:

1. Human Physiology- The Mechanism of Body Function By Vander, Sherman, TMH Ed.1981.
2. Introductions to Biomedical Equipment Technology By Joseph J. Carr & John M. Brown, Publisher, Pearson Education,
3. Biomedical Instrumentation and Measurements By Leslie Cromwell, Fred J. Weibell , 2nd edition, Prentice Hall India Learning Private Limited;.
4. Handbook of Biomedical Instrumentation By R. S. Khandpur, TMH

References Books:

1. Biomedical Digital Signal Processing, Tompkins, PHI .
2. Biomedical Instrumentation, Dr. M. Arumugam , Anuradha Publications,
3. Text book of clinical Ophthalmology- Ronald Pitts Crick, Pang Khaw, 2nd Edition, World Scientific publication. ISBN 981-238-128-7

Third Year Instrumentation Engineering
Web Technology

Course Code:	INPEC505C	Credit	03
Contact Hours:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Internet

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To explain basics of server side scripting using PHP
2	To familiarize various concepts of application development using JSP
3	To facilitate students to connect to databases using JDBC
4	To impart servlet technology for writing business logic
5	To explain web application development procedures

Course Outcomes: Students will be able to

505C.1	Analyze the difference between and PHP and XML
505C.2	Create web pages using PHP
505C.3	Design web application using MVC architecture
505C.4	Understand the concept of JAVA SCRIPTS
505C.5	Identify the difference between the JSP and Servlet.
505C.6	Apply JDBC and ODBC technologies to create database connectivity

Topics covered:

Unit I: Web Basics and Overview(6 hrs)

Introduction to Internet, World Wide Web, Web Browsers, URL, MIME, HTTP, Web Programmers Toolbox. HTML Common tags: List, Tables, images, forms, frames, Cascading Style Sheets (CSS) & its Types. Introduction to Java Script, Declaring variables, functions, Event handlers (onclick, onsubmit, etc..) and Form Validation

Unit II: Introduction to XML (6 hrs)

Document type definition, XML Schemas, Presenting XML , Introduction to XHTML, Using XML Processors: DOM and SAX. PHP: Declaring Variables, Data types, Operators, Control structures, Functions

Unit III: Web Servers and Servlets(6 hrs)

Introduction to Servlets, Lifecycle of a Servlet, JSDK, Deploying Servlet, The Servlet API, The javax. Servlet Package, Reading Servlet parameters, Reading Initialization parameters. The javax. servlet HTTP package, Handling Http Request & Responses, Cookies and Session Tracking.

Unit IV: JavaScript and jQuery: (7 hrs)

Basics of JavaScript and Client-side scripting language, JavaScript syntaxes for variables, functions, branches and repetitions. JavaScript alert, prompt and confirm. Objects in JavaScript, Access/Manipulate web browser elements using DOM Structure, forms and validations, JavaScript events, Basics of jQuery, jQuery syntaxes, jQuery selectors

Unit V: Topics and Contents Web Technology Frameworks: (6 hrs)

Express Framework: Introduction to Express Framework, Getting Started with Express, First Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling

Unit VI: JSP Application Development: (5 hrs)

The Anatomy of a JSP Page, JSP Processing. JSP Application Design and JSP Environment, JSP Declarations, Directives, Expressions, Scripting Elements, implicit objects

Text Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson

References Books:

1. Programming world wide web-Sebesta, Pearson Education,2007.
2. Internet and World Wide Web – How to program by Dietel and Nieto PHI/ Pearson EducationAsia.
3. Jakarta Struts Cookbook, Bill Siggelkow, S P D O‘ Reilly for chap8
4. March’s beginning JAVA JDK Murach,SPD
5. An Introduction to WEB Design and Programming –Wang-Thomson
6. PHP: The Complete Reference Steven Holzner TataMcGraw-Hill.

Third Year Instrumentation Engineering
Automation in Production System and Management

Course Code:	INOEC506	Credit	03
Contact Hours:	03 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Knowledge of basic electronics and electrical engineering.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	External	40
2.	End Semester Examination	External	60

Course Objectives

1	Learn the automation in manufacturing system
2	Explore the process of production process planning

Course Outcomes: Students will be able to

506.1	Illustrate the various automation processes
506.2	Describe the software and hardware tools for the production processing planning

Topics covered:

Week 1	:	Introduction to Manufacturing and Production Systems
Week 2	:	Automation in Manufacturing and Production Systems
Week 3	:	Product Development Process and Automation
Week 4	:	Fundamentals of NC Technology: Part-I
Week 5	:	Fundamentals of NC Technology: Part-II
Week 6	:	Flexible and Programmable Automation
Week 7	:	Cellular Manufacturing Systems
Week 8	:	Flexible Manufacturing Systems: Part-I
Week 9	:	Flexible Manufacturing Systems: Part-II
Week 10	:	Fundamentals of Robotic Systems
Week 11	:	Automated CAPP (Part-I)
Week 12	:	Automated CAPP (Part-II)

MOOC: Automation In Production Systems and Management:

https://onlinecourses.nptel.ac.in/noc24_mg117/preview

Books and references

1. Groover, M P, Automation, Production Systems, and Computer Integrated Manufacturing, Third Edition, Pearson Prentice Hall, Upper Saddle River
2. Groover, M P and Zimmers, E W Jr, CAD/CAM: Computer-aided Design and Manufacturing, Prentice-Hall of India Private Ltd.

Third Year Instrumentation Engineering			
Industrial Automation Lab			
Course Code:	INPCC507	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Practical 50 Marks		

Pre-requisites: Analog and Digital Techniques

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical	External	50

Course Objectives

1	To introduce the basics of PLC, HMI, and DCS
2	To explain ladder programming using advanced PLC instructions
3	To describe interfacing of analog and digital devices with PLC
4	To explain the configuration, operation and programming of DCS

Course Outcomes: Students will be able to

507.1	Understand the fundamentals of PLC, PLC interfacing and HMI.
507.2	Develop SCADA system for given applications.
507.3	Describe the software and hardware DCS configuration.
507.4	Explain DCS operation and integration.
507.5	Develop FBD program for automation and explain advanced techniques in DCS
507.6	Explain various DCS applications.

List of Experiments:

Students are required to perform minimum 10 experiments from the given list.

Any 2 from 1 to 3

1. Develop and Simulate Ladder program for comparison operations using PLC.
2. Develop and Simulate Ladder program for math operations using PLC.
3. Develop and Simulate Ladder program using sequencer.

Any 2 from 4 to 7

4. Develop and Simulate Ladder program for one application of BCD in/Discrete Out/BCD out/Analog out.
5. Develop and Simulate Ladder program for one application of Analog in/Analog out.
6. Develop and Simulate Ladder program for PID controller using PLC for Level/Flow/Temp Control Systems.
7. Interfacing PLC to hydraulic & Pneumatic circuits.

Any 4 from 8 to 13

8. To study the detail architecture of any typical DCS system
9. To start and stop electric motor/Pump using DCS
10. To connect field device (Transmitter and Control Valve) and its configuration for input and output channels in DCS
11. Case study of DCS for any cloud based Industrial application.
12. To prepare specification sheet of DCS for any industrial application.
13. Creating and configuring a project and tags in SCADA.

Virtual lab experiments any 2 from 14 to 17

14. Study, understand and perform experiments on timers and counters used in DCS.
15. Logic implementation for Bottle Filling Application.
16. Tune PID controller for heat exchanger using DCS
17. Develop graphical user interface for the fermenter plant

Text Books:

1. Programmable Logic Controllers: Principles & Applications by John W. Webb, Ronald A. Reis, Prentice Hall of India, 5th ed.
2. Introduction to Programmable Logic Controllers by Gary Dunning, Delmar Thomson Learning, 3rd ed.
3. Krishna Kant, Computer-based Industrial Control, Prentice Hall, New Delhi, 1997.
4. Computer aided process control, S. K. Singh, PHI.

References Books:

1. Programmable Logic Controller by Frank D Petruzella, McGraw-Hill Education, 5th ed.
2. Programmable Logic Controllers by W. Bolton, Elsevier Newness publication, 4th ed.
3. Programmable Controller by T. A. Huges, ISA publication, 2nd ed.
4. SCADA by Stuart A. Boyer, ISA 1999.
5. Distributed computer control for industrial automation, Popovik, Bhatkar, Dekkar Pub.
6. Understanding Distributed Process Systems For Control, Samuel Herb, ISA.

Third Year Instrumentation Engineering Embedded System Design Lab			
Course Code:	INPCC508	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Termwork examination 50 Marks		

Pre-requisites:

- Digital Electronics, Basic Electronics Engineering, Operating System..

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	50

Course Objectives

1	To study the architecture and instructions set in 8051 Microcontroller.
2	To write the codes in assembly and embedded C programming.
3	To interfacing the various I/O peripherals to the 8051 microcontroller.
4	To write codes in machine learning and embedded system
5	To study the implementation of embedded systems in advance tools.

Course Outcomes: Students will be able to

508.1	Explain the architecture of 8051 microcontroller.
508.2	Illustrate the execution of instructions in assembly and embedded c programming language.
508.3	Demonstrate the timers and serial communication programs.
508.4	Model the various interfacing peripherals to the 8051 microcontroller.
508.5	Develop a project based on Raspberry Pi Platform and Arduino.
508.6	Learn how to create a model in Matlab Simulink.

List of Experiments:

Students are required to perform minimum 10 program experiments from the given list.

1. Write programs based on various addressing modes and assembler directives.
2. Write programs based on Arithmetic and Logical Instructions in Assembly and Embedded C.
3. Write programs based on Branch Instructions in Assembly and Embedded C.
4. Write program on various code conversion.
5. Write programs based on Looping, Counting, and Indexing concept in Assembly and Embedded C.
6. Write programs to introduce delay using timers.
7. Write programs to turn ON/OFF LED using interrupt.
8. Write programs to generate various waveforms.
9. Write programs to interface 4x4 matrix keypad.
10. Write programs to interface LCD.
11. Write programs to interface 7 segment display.
12. Simulink design for embedded c coder.

Text Books:

1. The 8051 Microcontroller Architecture, Programming and Applications by Kenneth J. Ayala, Penram International Publications
2. “The 8051 Microcontroller and Embedded Systems – using assembly and C”, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
3. “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Raj Kamal, Pearson Education, 2005

References Books:

1. Embedded System Design – Frank Vahid, Tony Givargis, John Wiley. Y Daniel Liang, “Programming and customizing the 8051 microcontroller, Predko Michael, McGrawHill, International edition

Third Year Instrumentation Engineering Data Science Lab

Course Code:	INPEC509 A	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Oral 50 Marks		

Pre-requisites:

- Basic Python programming knowledge .

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral	External	50

Course Objectives

1	To explain statistical methods for data analysis.
2	To demonstrate exploratory data analysis and data visualization.

Course Outcomes: Students will be able to

509A.1	Demonstrate statistics for data analysis.
509A.2	Demonstrate data science packages.
509A.3	Demonstrate data cleaning methods.
509A.4	Create data visualization desktop.

List of Experiments:

Students are required to perform all experiments from the given list.

1. Statistical analysis of dataset
2. Students performance analysis. Dataset: StudentsPerformance.csv
3. Missing value treatment of dataset. Dataset: Toyota.csv
4. Correlation analysis of dataset. Dataset: Toyota.csv
5. Data preparation:
Download heart dataset from following link.
<https://www.kaggle.com/zhaoyingzhu/heartcsv>
Perform following operation on given dataset.
 - a) Find Shape of Data
 - b) Find Missing Values
 - c) Find data type of each column
 - d) Finding out Zero's
 - e) Find Mean age of patients

List of Experiments:

6. Data visualization: Plot frequency distribution of fuel type using bar plot.
Dataset: Toyota.csv
7. Create 'price class for cars' having three categories: Low, Medium and High using control loops. Dataset: Toyota.csv
8. Power BI dashboard
9. VLAB1: File operation
10. VLAB2: Word analysis (NLP)

Text Books:

1. Python for data analysis by O'Reilly
2. Data Visualization in python by Daniel Nelson
3. Mastering Python for Data Science by Samir Madhavan
4. Introduction to Data Science by Iguar, Segui, Springer, 2017

References Books:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing, and Presenting Data by John Wiley & Sons
2. Python for Data Analysis by W McKinney
3. Think Stats: Probability and Statistics for Programmers by Allen B. Downey
4. Elements of Statistical Learning by Hastie, Tibshirani, Friedman, Springer, 2011
5. The art of Data Science by Matsui, Peng, 2016
6. Data Science from Scratch by Grus, Google Books, 2015

Third Year Instrumentation Engineering Biomedical Instrumentation			
Course Code:	INPCC509B	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Oral examination 50 Marks		

Pre-requisites:

- Digital Electronics, Basic Electronics Engineering, Operating System..

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral	External	50

Course Objectives	
1	To learn the all types of Bio electrodes and measurement techniques
2	To acquire the skill to handling the biomedical equipment's.

Course Outcomes: Students will be able to	
509B.1	Select and apply the appropriate bioelectrode for measurement of physiological parameters.
509B.2	Demonstrate his/her skills by using biomedical equipment's.
509B.3	Explain the function of instruments and its working

List of Experiments:

Students are required to perform minimum 08 experiments from the given list.

1. To study bio electrodes.
2. To study various preamplifier used in biomedical applications.
3. To Design a Notch Filter for Power Line Frequency.
4. To study Electrocardiogram
5. To Measure Blood Pressure Using Sphygmomanometer, Calibration of BP apparatus
6. To Implement a Heart Rate Meter.
7. To study Phonocardiogram.
8. To study Electro surgical Unit.
9. To Study Electroencephalogram (EEG)/ Electromyogram (EMG)
10. To study of Audiometer.
11. To study of spirogram.
12. To study Bio Bench.
13. To study Power lab.
14. Monitoring of Electrocardiogram (ECG) for chest leads V1-V6
15. Monitoring of Electroencephalogram (EEG) signal for different lobes

Text Books:

1. Human Physiology- The Mechanism of Body Function By Vander, Sherman, TMH Ed.1981.
2. Introductions to Biomedical Equipment Technology By Joseph J. Carr & John M. Brown, Publisher, Pearson Education,
3. Biomedical Instrumentation and Measurements By Leslie Cromwell, Fred J. Weibell , 2nd edition, Prentice Hall India Learning Private Limited;.
4. Handbook of Biomedical Instrumentation By R. S. Khandpur, TMH

References Books:

1. Biomedical Digital Signal Processing, Tompkins, PHI .
2. Biomedical Instrumentation, Dr. M. Arumugam , Anuradha Publications,
3. Text book of clinical Ophthalmology- Ronald Pitts Crick, Pang Khaw, 2nd Edition, World Scientific publication. ISBN 981-238-128-7

**Third Year Instrumentation Engineering
Web Technology Lab**

Course Code:	INPEC509C	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Oral examination 50 Marks		

Pre-requisites:

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral	External	50

Course Objectives

1	To explain basics of server side scripting using PHP
2	To explain web application development procedures

Course Outcomes: Students will be able to

509C.1	Analyze the difference between and PHP and XML
509C.2	Understand the concept of HTML

List of Experiments:

Students are required to perform minimum 08 experiments from the given list.

1. Design a web page to demonstrate the use of different HTML5 tags.
2. Create HTML Page with JavaScript which takes Integer number as input and tells whether the number is ODD or EVEN.
3. Design a web page to demonstrate the use of CSS3 tags.
4. Create XML file to store student information like Enrollment Number, Name , Mobile Number , Email Id.
5. Develop a JavaScript to display today's date.
6. Write a php program to display today's date in dd-mm-yyyy format.
7. Write a php program to print first 10 Fibonacci Numbers.
8. Design a simple application using Express framework.
9. To demonstrate working of HTML code and create basic HTML pages using proper syntax.
10. Applying attributes in HTML tags

Text Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
2. Core SERVLETS AND JAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson

References Books:

1. Programming world wide web-Sebesta, Pearson Education,2007.
2. Internet and World Wide Web – How to program by Dietel and Nieto PHI/ Pearson EducationAsia.
3. Jakarta Struts Cookbook, Bill Siggelkow, S P D O' Reilly for chap8
4. March's beginning JAVA JDK Murach,SPD
5. An Introduction to WEB Design and Programming –Wang-Thomson
6. PHP: The Complete Reference Steven Holzner TataMcGraw-Hill.

Third Year Instrumentation Engineering Foreign Language Japanese Level			
Course Code:	IOHSM5ACB	Credit	1
Contact Hours:	01Hr/Week	Type of Course:	Lecture
Examination scheme:	Term-work 25 marks		

Pre-requisites:

Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives

1	To meet the needs of an ever growing industry with respect to language support.
2	To get introduced to Japanese society and culture through language.

Course Outcomes: Students will be able to

5ACB.1	Demonstrate basic communication skills.
5ACB.2	Show knowledge of Japanese script.
5ACB.3	Apply skills to reading, writing and listening
5ACB.4	Develop interest to pursue professional Japanese Language courses.

Topics covered:

UNIT I Introduction to Japanese Language (6 hrs.)

Introduction to Japanese Language and scripts (Hiragana, Katakana, and Kanji), Basic greetings.

Hiragana: Modified Kana, Double consonant, Letters combined with ya, yu, yo, Long vowels, extended greetings and expression.

Self-Introduction: Introducing another person, Numbers, Months, Dates (asking and telling birthday), Telephone numbers, Stating one's age, days of the week. Audio learning

UNIT II: Katakana ,Time and Transport Basics (6 hrs.)

Katakana basic Script, Denoting things (nominal & prenominal demonstratives) Purchasing at the Market / in a shop / mall (asking & stating price).

Introduction to counters - Part 1

Katakana: Modified kana, double consonant, letters with ya, yu, yo, Long vowels.

Describing time, describing starting & finishing time (kara~made) Point in time (denoting the time when any action or the movement occurs)

Means of transport (Vehicles), Places, Countries, Indicating movement to a certain place by a vehicle. Audio learning

Text Books:

1. Minna No Nihongo, “Japanese for Everyone”, Elementary Main Textbook 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. George Trombley, Yukari Takenaka “Japanese from Zero!” Learn From Zero Publisher

MOOC/NPTEL courses

1. NPTEL Course on “**JapaniBhasha –SaralSwaroop (Japanese course taught in Hindi) ”**

Link of the Course: https://onlinecourses.nptel.ac.in/noc23_hs76/preview

2. **NPTEL Course on**” Introduction to Japanese Language and Culture”

Link of the Course :https://onlinecourses.nptel.ac.in/noc19_hs52/preview

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Presentation
- Report

**Third Year Instrumentation Engineering
Foreign Language Level-I German**

Course Code:	IOHSM5ACA	Credit	1
Contact Hours:	1 Hrs/week (P)	Type of Course:	Lecture
Examination Scheme	Term Work 25 Marks		

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	25

Course Objectives

1	To get introduced to the Culture, Routine of the German Society through language.
2	To meet the needs of ever growing German industry with respect to language support.

Course Outcomes: Students will be able to

5ACA.1	Use German language for basic communication.
5ACA.2	Apply the knowledge of German script.
5ACA.3	Read, write and improve their listening skills.
5ACA.4	Grasp the basic sentence structure and build a good foundational vocabulary.

Topics covered:

Unit I: Introduction to the German Language-I (6 hrs)

Introduction of German Alphabets,

- Spell the names
- Addresses
- Numbers,
- Telephone numbers
- Ordinal Numbers
- Pin code Numbers
- Dates
- Birthdates
- Age
- days of the week
- Months

Unit II: Introduction to the German Language-II (6 hrs)

- Basic Greetings
- Personal Pronouns
- Possessive Pronouns
- Self-Introduction
- Introducing other people, about family, friends, course mates
- Introduction to seasons, and seasons in Germany and in neighboring countries.

Text Books:

1. “ Netzwerk A-1 (Deutsch als Fremdsprache) “ Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Tipps und Uebungen A1

Online Resources:

1. Practice Material like Listening Module, reading Texts
2. Nptel Course On German -I Language
3. Online German-English Dictionary www.Leo.Org

Third Year Instrumentation Engineering
Seminar and Technical Paper writing

Course Code:	IOHSM601	Credit	02
Contact Hours:	01 Hr/Week(L) 02 Hrs/Week(P)	Type of Course:	Lecture /Practical
Examination Scheme	Termwork-50 marks		

Pre-requisites: Industrial automation.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	50

Course Objectives

1	To prepare students to communicate effectively as professionals.
2	To train students to use visual aids effectively
3	To implant technical writing skills
4	To develop presentation and technical writing skill

Course Outcomes: Students will be able to

601.1	Analyze communication-related problems and improve communication skill.
601.2	Use various types of technical communication as per need
601.3	Write proposals and reports
601.4	Develop key skills in research, dissemination and documentation

Topics covered:

Unit I: Technical Communication : Oral (6 hrs.)

Basics of Technical Communication, different forms of communication and advanced communication skills, dynamics of professional presentations , group discussions, etiquettes and mannerisms, job interviews (online/offline mode), public speaking, oral presentation.

Unit II: Technical Communication : Written (6 hrs.)

Technical proposal, technical writing: efficient process to create a report, research paper, report writing and documentation style-LaTex, use of visual aids, ethics in writing using plagiarism tools, resume writing.

Text Books:

1. Sunita Mishra, "Communication Skills for Engineers" Pearson Education
2. Prof. K. R. Laxminarayanan and Dr. T. Murugavel "Communication Skills for Engineers" SCITECH.
3. Sharon J Gerson and Steven Gerson "Technical Writing – Process& Product", Pearson Education.
4. Danial Riordan, Steven E. Pauley Technical Report Writing Today
5. Krishna Mohan, Meera Banerji "Developing Communication skills", Laxmi Publications.
6. Meenakshi Raman and Sangeeta Sharma," Technical Communication Principles and Practice", Oxford University Press.

References

1. Sanjay Kumar and Pushp Lata, "Communication Skills" Oxford University Press.
2. Davies J.W. "Communication for engineering students", Longman
3. Eisenberg, "Effective Technical Communication", Mc. Graw Hill.
4. Robert A. Day, "How To Write and Publish a Scientific Paper", Fifth Edition, Oryx Press, Phoenix, AZ, 1998.

Note: The assessment for the subject shall be based on presentation and report submission.

List of Assignments / Activities :

Any eight of the following

1. Introduction to technical communication
2. Group Discussion
3. Official/Public Speaking
4. Communication ethics
5. Conversational skills for job interviews
6. Theme based seminar/ oral presentation /poster presentation
7. Writing ethics-letter of application, resume e-mails.
8. Develop proposal in LaTeX for selected research project
Publication process: How to write and submit paper for conference, journal, the evaluation process, how to communicate with the editors, copyright, plagiarism.

Third Year Instrumentation Engineering Industrial Data Exchange			
Course Code:	INPCC602	Credit	04
Contact Hours:	3 Hrs/week (L) 1 Hr/week (T)	Type of Course:	Lecture & Tutorial
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Industrial automation.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives	
1	To introduce the basic components of networking and network topologies.
2	To provide details on OSI-ISO and TCP/IP network models.
3	To expose students to various data communication protocols.
4	To introduce network diagnostic and health monitoring tools.

Course Outcomes: Students will be able to	
602.1	Differentiate various network components and network topologies.
602.2	Identify OSI-ISO, TCP/IP network models.
602.3	Explain the architecture, applications, advantages and limitations of HART, Foundation Fieldbus and ProfiBus protocols.
602.4	Explain the architecture, applications, advantages and limitations of Ethernet and OPC protocols.
602.5	Explain the architecture, applications, advantages and limitations of Device Net, Control Net, BacNet protocols.
602.6	Explain the types and need of network diagnostic and health monitoring tools.

Topics covered:
<p>Unit I: Introduction to Industrial Communication (6 hrs.) Introduction to ISA 95 Communication Pyramid Network Components: Types and applications of Cables, Connectors, Switches, Hub, Router, Protocol Translators, Edge Devices, Repeaters, Firewall. Network Topology: Working principles and applications of STAR Topology, Mesh Topology, BUS Topology, Ring Topology</p>

Unit II: Reference models and Protocols (8 hrs.)

Basics of Protocol and its need, Purdue model

Reference Models: Brief functional description of OSI-ISO Reference Model, TCP/IP Reference Model

Communication Standards: RS232, RS422, RS485 interface standard, their comparison

Modbus: (ASCII/RTU), MODBUS protocol structure -function codes

Unit III: HART, Foundation Fieldbus and ProfiBus (8 hrs.)

HART: Concept of Highway Addressable Remote Transducer (HART), HART and smart Instrumentation, frame structure, programming, implementation examples, benefits, advantages and limitation, Troubleshooting.

Foundation Fieldbus: Introduction, characteristics, variants, frame structure, programming, implementation examples, benefits, advantages and limitations

ProfiBus: Introduction, architecture, variants, it's location, advantages, disadvantages, physical layer and wiring, applications.

Unit IV: Ethernet and OPC (7 hrs.)

Ethernet: Industrial Ethernet, Introduction, packet formats of Ethernet, Overview and comparison of Mbps Ethernet, Fast Ethernet, Gigabit Ethernet, Introduction of CC link, Ethercat, Powerlink.

OPC: Concept of OPC (Object linking and embedding for Process Control), OPC UA Protocol, Introduction, Frame Structure, Implementation Examples

Unit V: Device Net, Control Net, BacNet (7 hrs.)

Device Net: Introduction, Frame Structure, Implementation Examples, advantages, disadvantages

Control Net: Introduction, Frame Structure, Implementation Examples, advantages, disadvantages

BacNet: Introduction, Frame Structure, Implementation Examples, advantages, disadvantages

Unit VI: Network Diagnostic & Health Monitoring (6 hrs.)

Good Networking Practices, Network health Monitoring, Network Diagnostics. Introduction to Various Tools : Wireshark, Packetsniffer

Text Books:

1. Practical Industrial Data Networks: Design, Installation and Troubleshooting by Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Newnes Publication, Elsevier First Edition, 2004
2. Computer Buses, William Buchanan, CRC Press, 2000.
3. Data Communications & Networking, A. Behrouz Forouzan, 3RD edition, Tata Mc Graw
4. Industrial Data Communications, Lawrence M. Thompson and Tim Shaw, Fifth Edition, ISA Press, 2015.

References

1. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.
2. Wireless Communication: Principles and Practice, William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.
3. Bowden, R., "HART Application Guide", HART Communication Foundation, 1999.

Third Year Instrumentation Modern Control Theory			
Course Code:	INPCC603	Credit	3
Contact Hours:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Basic knowledge of Electrical & Electronics Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	Constructing State Space Models
2	Analyzing Control Systems
3	Evaluating Controllability, Observability, and Stability
4	Designing Control Systems using State Space
5	Understanding and Working with Sampled Data Control Systems

Course Outcomes: Students will be able to

603.1	Construct state space models and represent dynamic systems
603.2	Analyze control systems using eigenvalues and eigenvectors
603.3	Evaluate controllability, observability, and stability
603.4	Design control systems using state space
603.5	Understand and work with sampled data control systems
603.6	Analyze sampled data control systems

Topics covered:

Unit I: INTRODUCTION TO STATE SPACE (6 hrs.)

Terminology of State Space

1.1 State Space Representation

Describes a system using a set of first-order differential equations. Expressing the system's behavior in terms of state variables.

1.2 Physical Variable State Space Representation

Represents the system using physical variables (e.g., position, velocity) as state variables.

1.3 Phase Variable Forms

Companion Forms: Controllable Canonical Form and Observable Canonical Form.

Canonical Variable Forms: Diagonal Canonical Form and Jordan Canonical Forms.

Determination of Transfer Function from State Space Model: Deriving the transfer function that relates the input and output of the system based on its state space representation.

Unit II: ANALYSIS OF CONTROL SYSTEM IN STATE SPACE (6 hrs.)

2.1 Concept of Eigenvalues and Eigenvectors:

Eigenvalues and eigenvectors are essential in analyzing the behavior of linear systems.

2.2 Diagonalisation of Plant Matrix:

Achieved through similarity transformations.

Involves the Vandermonde matrix.

2.3 Solution of Homogeneous State Equation:

Finding the solution to the system's state equation when the input is zero.

2.4 State Transition Matrix:

Definition, derivation, and properties.

Computation by Laplace transform method, Cayley Hamilton method, and similarity transformation method.

2.5 Solution of Non-homogeneous State Equation:

Finding the solution when the system has a non-zero input.

Unit III: CONTROLLABILITY, OBSERVABILITY, AND STABILITY (6 hrs.)

3.1 Controllability and Observability:

Definitions and matrices (Controllability matrix, Observability matrix).

Investigation using Kalman's test and Gilbert's test.

3.2 Stability:

Concepts of asymptotic stability and stability in the sense of Lyapunov.

Lyapunov stability analysis (direct method) of continuous-time LTI systems.

Unit IV: DESIGN CONCEPTS IN STATE SPACE (6 hrs.)

4.1 State Variable Feedback:

Utilizing state variables in feedback control systems.

4.2 Control System Design via Pole Placement:

Necessary and sufficiency conditions.

Computation of state feedback gain matrix K through sufficiency condition, Ackermann formula, and coefficient comparison method.

4.3 State Observer:

Necessity, types, theory. Principle of duality between state feedback gain matrix K and observer gain matrix K_e . Design of full-order state observer.

Unit V: SAMPLED DATA CONTROL SYSTEMS (6 hrs.)

5.1 Introduction to Discrete Time Control Systems:

Basics of digital control systems.

5.2 Necessary for Digital Control System:

Fundamental concepts needed for understanding and implementing digital control.

5.3 Block Diagram of Digital Control Systems:

Visualization of digital control systems.

5.4 Operation and Equivalents of ADC and DAC:

Analog-to-digital and digital-to-analog conversion processes.

5.5 Analytical Equivalent Block Diagram of Digital Control System:

Representation of digital control systems in terms of mathematical blocks.

5.6 Sampling Theorem:

Fundamental principle governing sampling. Sampling and Reconstruction Process:

Fundamental processes in digital control systems.

5.7 Operation and Transfer Function of Zero-Order Hold:

Representation and characteristics of zero-order hold in sampled data control systems.

Unit VI: ANALYSIS OF SAMPLED DATA CONTROL SYSTEMS (6hrs.)

6.1 Solution of Difference Equations using Z-Transforms Method:

Applying Z-transforms to analyze and solve difference equations.

6.2 Pulse Transfer Function:

Representation of discrete-time systems in terms of input and output signals.

6.3 Stability Analysis of Discrete Time Control Systems:

Using Jury stability test, bilinear transformation, and Routh stability test to assess stability in discrete-time systems.

Text Books:

1. Control Systems Engineering Author : Nagrath and Gopal Publisher : New Age Publication
2. Modern Control Engineering Author : Katsuhiko Ogata Publisher : Prentice Hall of India
3. Modern Control System Author : Richard C. Drof and Robert H. Bishop Publisher : 11th Edition Person Int.
4. Automatic Control Systems Author : Benjamin C.Kuo Publisher : Farid Golnaraghi, John Wiley & Sons.

References

1. A. Nagoor Kani, Control System, RBA Publications.
2. M. Gopal , Digital Control & State Variable Methods, TMH..
3. M. Gopal, "Control Systems, Principles and Design", Second Edition, TMH, New Delhi, 2002.

Third Year Instrumentation Engineering Project Engineering and Management			
Course Code:	INPCC604	Credit	3
Contact Hours:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Knowledge of Organization Structure ,Types & Function.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To relate and apply the basic concept of Project organization and management for instrumentation projects
2	To learn and understand the project Initiation and Finance Management.
3	To Know the development stages of Project .
4	To learn and know the use of various standards in instrumentation Projects
5	To get the Knowledge of front end engineering design and testing Activity its documentation.

Course Outcomes: Students will be able to

604.1	Evaluate the role and responsibilities in the project.
604.2	Identify the tools of project planning and budget .
604.3	Apply the design documents/ activities required in different phases of the project.
604.4	Classify the standards required for project development.
604.5	Interpret the design information from the documents.
604.6	Implement various construction and testing activities.

Topics covered:

Unit I: Project Management and Project Teams (06)

A] Project Management:

Introduction and objectives of Project Management, Types of projects and related information. Project manager, purpose of project management. Project Organization Techniques -Matrix project organization, Project-Oriented project organization

B] Project Team:

Teamwork, teams for small project, working with multiple teams, design teams, team management, key factors in team leadership, motivating teams

Unit II: Project Initiation and Finance Management (07)

Design & construction process, private v/s public projects, phases of a project, project strategy.

Importance of early estimates, estimating work process, establishing an estimate work plan.

Methods & Techniques of early estimate, estimate checklist & documentation, project budgets, design budgets.

Unit III: Development stages of project (07)

Organizational structures, forming the project team, kick-off meeting, work packages, project execution plan, problems in developing project definition, design proposals, engineering project controls, techniques for planning and scheduling

Unit IV Instrumentation Preliminary and FEED Project Engineering Documents and Standards (08)

Introduction to ISA standards: ISA S-5.1, 5.2, 5.3, 5.4, 5.5 and S-20, Preliminary Engineering Documents: PFD, P&ID (ISA S-5.1, 5.3), Process Control Narratives. Front End Engineering and Design (FEED) documents: Plant and piping layouts, Instrument schedule, I/O schedule, Instrument specification sheets (ISA S-20), logic diagram (ISA S-5.2), sizing and calculation documents, Instrument layout, Junction box layout, system Architecture and network layout diagrams, Control room layouts.

Unit V : Detail Engineering Design (06)

Cable Engineering: Class of conductors, Types, Specification, Selection, Cable identification schemes, Cable trays. Earthing and Grounding for General and power Signals. Instrument Loop wiring diagrams (ISA S-5.4), Instrument Hook up, BOM and MBOM. Control room layout, Panel layout and General arrangement (GA) drawings.

Unit VI: Project Close out and Testing Activities (07)

System testing & start-up, final inspection, guarantee of warranties.

Construction Activities – Installation & commissioning activities, documents required at this stage. Factory Acceptance Test (FAT), Customer Acceptance Test (CAT), Sites Inspection & Testing (SAT), Cold commissioning & hot commissioning.

Text Books:

1. Management systems by John Bacon (ISA).
2. Project Management A System Approach to Planning, Scheduling and Controlling by Harold Kerzner (Van Nostrand Reinhold Publishing).
3. Applied instrumentation in process industries by Andrew & Williams (Gulf Publishing).

References Books:

1. Garold D. Oberlender, “ Project Management for Engineering and Construction “
Mc Grow Hill.
2. Instrument Installation Project Management (ISA).

Third Year Instrumentation Engineering Machine Learning			
Course Code:	INPEC605A	Credit	03
Contact Hours:	03 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Data science, basics of statistics.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To explain fundamental concepts of Machine Learning and its types, applications.
2	Introduction to supervised and unsupervised machine learning techniques.
3	To explain evaluation of machine learning models and generalize it.

Course Outcomes: Students will be able to

605A.2	Differentiate various regression techniques and evaluate their performance.
605A.3	Illustrate probabilistic machine learning algorithms.
605A.4	Compare different types of classification models and their relevant application.
605A.5	Explain the tree-based machine learning algorithms.
605A.6	Apply unsupervised machine learning clustering algorithm.

Topics covered:

Unit I: Introduction to Machine Learning (06)

Need for Machine Learning, What is Machine Learning, Definition, Machine Learning Life cycle, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning., Job Roles in Machine Learning, Applications of Machine Learning

Unit II: Supervised Learning: Regression Analysis (06)

Assumption of Regression, Simple Linear Regression, Multiple Linear Regressions, ordinary least square method, best fit line, MSE, MAE, R-Square, model performance evaluation

Unit III: Supervised Machine Learning: Probability Analysis (06)

Introduction to Logistic Regression, Probability, Odd Ratio, Sigmoid/Logic function , Introduction to KNN: Lazy Learner, Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski) and evaluation of KNN Model

Introduction to Naïve Bayes: Conditional Probability, Bayes Theorem, Naïve Bayes.

Unit IV: Support Vector Machine (06)

Introduction to SVM, Support Vectors, Margin, Hyper plane, Hard Margin and soft Margin, Linear separable data and nonlinear separable data, Introduction to various SVM Kernel to handle non-linear data – RBF, Gaussian, Polynomial, Sigmoid. Performance evaluation metrics- Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure

Unit V: Supervised Machine Learning: Classification Analysis (06)

Introduction to Decision Tree: Concepts and Terminologies: Root node, leaf node, decision node, branches/edges, Tree split criteria, Impurity Measures: Gini index, entropy, Information gain, and pruning. Introduction to Random Forest: Ensemble Learning of decision tree, over fitting and under fitting, Regularization, Evaluation Metrics, Model Hyper parameter tuning

Unit VI: Unsupervised Machine Learning: Clustering (06)

Clustering definition, Clustering types, Introduction to K Means Clustering, Centroid calculation, Distance measures, Elbow method, Silhouette method, Model evaluation.

Text Books:

1. Machine Learning For Absolute Beginners by Oliver Theobald
2. Python Machine Learning by Sebastian Raschka and Vahid Mirjalili
3. Understanding Machine Learning by Shai Shalev-Shwartz and Shai Ben-David
4. Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013 2.
5. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
6. Tom M. Mitchell, Machine Learning, 1997, McGraw-Hill, First Edition

References Books:

1. Introduction to Machine Learning with Python by Andreas C. Müller, Sarah Guido
2. Machine Learning For Dummies by John Paul Mueller and Luca Massaron
3. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy
4. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
5. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition
6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
7. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014

E- Books / E- Learning References:

1. Introduction to Machine Learning: <https://nptel.ac.in/courses/106/106/106106139/>
2. Machine Learning: <https://nptel.ac.in/courses/106/106/106106202/>
3. Machine Learning – Offered by Stanford Online - <https://www.coursera.org/learn/machine-learning>

Third Year Instrumentation Engineering
Building Automation

Course Code:	INPEC605B	Credit	3
Contact Hours:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Basic knowledge of Sensor Transducer and control system Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	Articulate the purpose and operation of HVAC system components, the operation of HVAC systems.
2	Apply knowledge of thermal comfort conditions and its impact on human comfort, productivity, And health.
3	To make students aware about the construction, operation various features of sensors and transducers.
4	Evaluate importance of fire safety systems
5	Demonstrate the security & access control system
6	Develop and implement preventive maintenance practices and schedules for building automation systems.

Course Outcomes: Students will be able to

605B.1	Define and articulate the fundamental concepts of Building Automation Systems (BAS), including its scope, historical development, and key components.
605B.2	Integrate HVAC systems effectively by applying control strategies and energy management techniques also apply principles of lighting control systems, incorporating daylight harvesting and occupancy sensing.
605B.3	Identify and define critical comfort parameters, including temperature, humidity, air flow, pressure, and air quality and recognize the significance of maintaining optimal comfort levels in indoor environments.
605B.4	Select appropriate AHU types based on established criteria and demonstrate an understanding of energy-efficient design principles.
605B.5	Evaluate and differentiate between centralized and decentralized access control systems. Demonstrate knowledge of various card technologies, including smartcards, proximity cards, and Mi fare cards.
605B.6	Evaluate case studies on energy optimization, identifying successful examples and associated challenges.

Topics covered:

Unit I: INTRODUCTION TO BUILDING AUTOMATION (6 hrs.)

1.1 Overview of Building Automation Systems (BAS)

Definition, scope, and importance, Historical development and evolution

1.2 Introduction to Intelligent Buildings

Definition and characteristics of intelligent buildings, Lifecycle phases of buildings:

Design, construction, operation, and renovation

1.3 Components of BAS

Sensors, actuators, controllers, Communication protocols (BACnet, Modbus)

Unit II: BUILDING SYSTEM INTEGRATION (6 hrs.)

2.1 Integration of HVAC Systems

Heating, ventilation, and air conditioning control

Energy management strategies

2.2 Lighting Control Systems

Principles of lighting control

Daylight harvesting and occupancy sensing

2.3 Security and Access Control

Intrusion detection systems

Access control technologies

Unit III: Comfort Parameters for (6 hrs.)

Introduction to temperature, humidity, air flow, pressure, and air quality Importance of maintaining optimal comfort levels

3.1 Humidity Parameters: Definitions of humidity, specific humidity, relative humidity, dew point, and saturation point Importance of controlling humidity in indoor environments

3.2 Psychrometric Principles Dry bulb and wet bulb temperature concepts

Working principle of a psychrometer for humidity measurement.

3.3 Measurement of CO₂ Levels Significance of monitoring CO₂ in indoor spaces

Techniques for measuring and controlling CO₂ levels

3.3 Air Filtration and Other Techniques Importance of air filtration for maintaining indoor air quality Overview of ozonisation and UV techniques for air purification

Unit IV: HVAC Air Systems - Air Handling Unit (AHU) & Terminal Units (VAV) (6 hrs.)

4.1 Concept of AHU

Definition and role in HVAC systems, Importance of air handling in maintaining indoor air quality, Components of AHU, Different Types of AHU.

4.2 Design Considerations

Selection criteria for different types of AHU, Balancing outdoor and return air ratios, Energy-efficient design principles,

4.3 Operation Modes in AHU.

Cooling Mode (Principles of cooling in AHU Applications and challenges Heating Mode , Working of heating coils in AHU Applications and considerations

Unit V: Building Security – Access Control (6 hrs.)

5.1 Basic Concepts of Access Control.

Definition and Significance Understanding the role of access control in building security Benefits of implementing access control systems. Access Control System Architecture .Overview of system components and their interactions Differentiating between centralized and decentralized systems Additional Devices (Two-man Rule, Time and Attendance, Guard Tour, Elevator Control), Secure and Non-Secure

Concepts.

5.2 Card Technology Overview

Types of Cards (Smartcard, Proximity Card, MI fare Cards)
Characteristics and applications of smartcards.

5.3 CCTV and Camera in Building

Understanding the fundamental role of Closed-Circuit Television (CCTV) in building security, System Architecture of CCTV System, Types of Cameras (Fixed, PTZ, Analog, Digital)

Characteristics and applications of fixed and Pan-Tilt-Zoom (PTZ) cameras

5.4 Video Management System (DVR, DVM, NVR)

Differentiating between Digital Video Recorder (DVR), Digital Video Matrix (DVM), and Network Video Recorder (NVR)

Unit VI: ENERGY MANAGEMENT AND OPTIMIZATION (6hrs.)

6.1 Energy Efficiency Strategies

Demand response and load shedding
Renewable energy integration

6.2 Building Performance Monitoring

Monitoring and analyzing energy consumption
Implementing energy-saving measures

6.3 Case Studies on Energy Optimization

Successful examples of energy-efficient buildings
Challenges and opportunities in energy management

6.4 Diagnostic Tools and Techniques

Identifying and resolving common issues
Use of diagnostic equipment

6.5 Preventive Maintenance Practices

Developing maintenance schedules

Text Books:

1. HVAC Systems Design Handbook, Fifth Edition by Roger W. Haines
2. HVAC Fundamentals, volume 1 to 3 by James E. Brumbaugh
3. Basics of Air Conditioning by ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0004 for online shopping)
4. Fire Alarm and Detection System: Quick Book by A. Bhatia.

References

1. All About AHU's by ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0005 for online shopping)
2. Chillers Basics by ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0009 for online shopping)

Third Year Instrumentation Engineering Robotics Automation

Course Code:	INPEC605C	Credit:	03
Contact Hours:	3 Hrs/week (L)	Type of Course:	Lecture
Examination Scheme	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Pre-requisites: Engineering Mechanisms and their Application, Introduction to Manufacturing, Matrices, Vectors, Electrical Technology, Industrial Electronics

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-Sem. Evaluation	Internal	40
2.	End Semester Examination	External	60

Course Objectives

1	To introduce various types of Robots and the functional elements of Robotics
2	To impart knowledge of robot drive systems
3	To introduce various types the end effectors
4	To educate on various sensors used in Robotic automation
5	To introduce the basic mathematical modeling of a robot
6	To impart knowledge of basics of Robot Programming and robotic Applications

Course Outcomes: Students will be able to

605C.1	Understand basic concepts of robotics
605C.2	Select appropriate drive for Robotic applications.
605C.3	To compare and select robot and end effectors as per application
605C.4	To select proper sensors for robot as per application requirement
605C.5	To know about the basic mathematical modeling of robot
605C.6	To know about the fundamentals of robot programming and applications

Topics covered:

Unit I: Fundamentals of Robotics (6hrs)

Historical development of Robotics, Definitions of Industrial Robot, Type and Classification of Robots, Asimov's laws of robotics, Robot configurations, Robot Components, Robot Degrees of Freedom, Work volume and work envelope, Robot Joints and symbols, Robot Coordinates, Robot Reference Frames, Resolution, accuracy and precision of Robot.

Unit II: Robot Drive Systems (6hrs)

Pneumatic Drives, Hydraulic Drives, Mechanical Drives, Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors, BLDC-Salient Features, Applications and Comparison of all these Drives, Micro actuators, selection of drive, Types of Gearbox: - Planetary, Harmonic, Cycloidal gearbox and gear Ratio, variable speed arrangements.

Unit III: End Effectors (6hrs)

Grippers, Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Advance Grippers- Adaptive grippers, Soft Robotics Grippers, Tactile Sensor Grippers; Various process tools as end effectors; Robot end effectors interface, Active and passive compliance, Selection and Design Considerations.

Unit IV: Robot Sensors (6hrs)

Transducers and sensors, Sensors in robotics, Principles and applications of the following types of sensors- Proximity Sensors, Photo Electric Sensors, Position sensors – Piezo Electric Sensor, LVDT, Resolvers, Encoders – Absolute and Incremental: - Optical, Magnetic, Capacitive, pneumatic Position Sensors, Range Sensors- Range Finders, Laser Range Meters, Touch Sensors, Force and torque sensors, Safety Sensor: Light Curtain, Laser Area Scanner, Safety Switches, Machine vision.

Unit V: Mathematical Modeling of a robot (6hrs)

General Mathematical Preliminaries on Vectors & Matrices, Link Equations and relationships, Direct Kinematics, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Composite Rotation matrix, Homogenous Transformations, Robotic Manipulator Joint Co-ordinate System, inverse kinematics of two joints.

Unit VI: Fundamentals of Robot Programming and Applications (6hrs)

Introduction to Robotic Programming, On-line and off-line programming, programming examples. Various Teaching Methods, Survey of Robot Level Programming Languages, A Robot Program as a Path in Space, Motion Interpolation, various Textual Robot Languages, Typical Programming Examples such as Palletizing, Loading a Machine Etc. Robots in manufacturing and non-manufacturing applications, a robot-based manufacturing system, Functional Safety in Robotic Application.

Text Books:

1. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi
2. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
3. Groover M.P.-Automation, production systems and computer integrated manufacturing Prentice Hall of India.

References Books:

1. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
2. Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd. , New Delhi, ISBN:987-81-203-3418-2, 2012
3. John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 2009
4. R K Mittal & I. J. Nagrath, Robotics and Control, McGraw Hill Publication, 2015.
5. Mike Wilson, Implementation of Robotic Systems, ISBN: 978-0-124-04733-4
6. www.roboanalyzer.com

E study material: NPTEL Course on Robotics:

https://onlinecourses.nptel.ac.in/noc19_me74/preview
https://onlinecourses.nptel.ac.in/noc20_de11/preview

Third Year Instrumentation Engineering			
Process Instrumentation			
Course Code:	INVSE606	Credit:	3
Contact Hours:	1 Hr/week (L) 4 Hrs/week(P)	Type of Course:	Lecture/Practical
Examination Scheme	Term-work 50 Marks	Practical 50 Marks	

Pre-requisites: Basics of process control

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	50
2.	Practical	External	50

Course Objectives

1	To demonstrate design procedure for control of Heat Exchanger, Boiler, Distillation column control, Dryer, Evaporator, Continuous and batch reactor.
2	To identify process variables, control variables and an appropriate manipulated variables for their control and disturbance variables.
3	To gain knowledge and analysis of unit processes and unit operations.
4	To provide students with knowledge about principle and design of controller for pumps and compressors.
5	Use of appropriate software tools (e.g. MATLAB, SCILAB etc. Control Toolbox & Simulink) for design of well-tuned control loops.

Course Outcomes: Students will be able to

606.1	Discuss the basic operations of Heat Exchanger, Dryer, Evaporator, Boiler, Distillation column, Reactors, Pumps and Compressors and Determine the scaling equations for unit processes and operations.
606.2	Analysis and design of controller for safety and process monitoring and understand the need for scaling of instruments.
606.3	Design an appropriate regulatory and servo controller (Feedback, Cascade and Feed forward) for Heat Exchanger, Dryer, Evaporator, Distillation column and Reactor to achieve desired performance.
606.4	Design an appropriate regulatory and servo controller (Feedback, Cascade, Selective Split range, Anti-surge) for Boiler, Pumps and Compressors to achieve desired performance.
606.5	Design/Develop, tuning, implementation and simulation of appropriate servo and regulatory controller for a given process using MATLAB Simulink and Estimate the performance measures. (Rise time, Settling time, Overshoot, Integral errors)

Topics covered:

Unit I: Instrumentation for heat exchangers and dryers (2 hrs.)

Operation of heat exchanger, controlled and manipulated variables in heat exchanger control problem, instrumentation for feedback, feed-forward, cascade control strategies for heat exchanger, types and operation of dryers, controlled and manipulated variables in dryer control problem, instrumentation for feedback and feed-forward control of various types of dryers.

Unit II: Instrumentation for evaporators (2 hrs.)

Types and operation of evaporators, Controlled and manipulated variables in evaporator control problem, instrumentation for feedback, feed-forward, cascade control strategies for evaporators.

Unit III: Instrumentation for distillation columns (2 hrs.)

Operation of distillation column, manipulated and controlled variables in distillation column control, instrumentation for flow control of distillate, top and bottom composition control, reflux ratio control, pressure control schemes.

Unit IV: Boiler Instrumentation (2 hrs.)

Operation of boiler, manipulated and controlled variables in boiler control, safety interlocks and burner management system, instrumentation for boiler pressure controls, air to fuel ratio controls, boiler drum level controls, steam temperature control, optimization of boiler efficiency.

Unit V: Pumps and Compressors Controls (2 hrs.)

Pumps: Types, On-off level, flow and pressure Control, Multi-pump system control, Starting and Stopping of pumps.

Compressors: Types, On-off Controls, Surge phenomenon, anti-surge control, throttling and override control.

Unit VI: Control Valves, Control Elements, Troubleshooting (2 hrs.)

Terminology associated with valves and final control elements, Components of a control valve, Applications of control valve types/elements, Role of the final control element in the control loop, Control valve actuators/operation, Facility practices related to process technician troubleshooting.

List of Practical Assignments:

Students are expected to perform experiments on above topics. (Using DCS, MATLAB, SCILAB etc. wherever required.)

1. Study of boiler controls (Using DCS*)
2. Study of distillation column controls (Using DCS*)
3. Study of pumps and compressor controls (Using DCS*)
4. Design and implementation of controller for heat exchanger.
5. Develop and Implement PLC program for safety interlocks of boiler
6. Design and implementation of controller for steam drum level control
7. Design and implementation of controller for surge vessel level control.
8. Design and implementation of controller for distillation column control
9. Develop cascade controller for evaporator/dryer
10. Design and implementation of controller for chemical reactor
11. Develop anti-surge control strategy for compressor controls
12. Develop feedback control strategy of pumps
13. MATLAB Simulation of Control Valve Components
14. MATLAB-Based Troubleshooting of Control Valves and Elements in Process Industries
15. Virtual Lab - Flow Through Pipes
16. Virtual Lab - Reaction kinetic studies in a batch reactor
17. Process Control Instrumentation – A case study on any plant.

Text Books:

1. “Chemical Process Control”, Stephanopoulos George, Prentice Hall of India.
2. “Boiler Control System”, D. Lindsey, McGraw Hill Publishing Company.
3. Optimization of Industrial Unit Processes: Bela G. Liptak

References

1. “Process Control, Instrument Engineering Hand book”, B.G. Liptak, Chilton Book Company.
2. “Hand book of Process Instrumentation”, Considine McGraw Hill Publishing company.1999.
3. Tuning of industrial control systems, ISA.
4. Control valve Handbook, ISA
5. Process Control Systems- F. G. Shinskey, TMH

Third Year Instrumentation Engineering Project Engineering and Management Lab			
Course Code:	INPCC608	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Oral examination 25 Marks		

Pre-requisites:

- Basic knowledge of ISA Symbols, Phases Of Project .

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral	External	25

Course Objectives

1	To Learn and understand the standards Symbol of ISA.
2	To know the work break down structure and Project schedule and cable scheduling
3	To prepare the Quotation, Comparative statements and Purchase orders.
4	TO Prepare the Documentation , Bill Of Material .

Course Outcomes: Students will be able to

608.1	Understand the ISA Symbol and its use.
608.2	Identify the tools of project planning and budget and Project Scheduling .
608.3	Apply the design documents/ activities required in Comparative Statement, Purchase Orders .
608.4	Classify the standards required for project development and cable Scheduling.
608.5	Interpret the design information from the documents and Prepare the bill of material

List of Experiments:

Students are required to perform minimum 08 experiments from the given list.

1. Study of standards and symbols (ISA)
2. Design and develop the project development Schedule – WBS.
3. Preparation of Inquiry, Quotation, Comparative Statement, Purchase Orders.
4. Development of Process and Instruments diagram of Typical Process.
5. Prepare the sample cable Schedule.
6. Prepare the Specification Sheet.
7. Prepare a loop wiring diagram.
8. Prepare the Bill of material and its documentation.
9. Prepare a Hook up drawings for installation of transmitters and control valve.
10. Prepare documents required for FAT of a control Panel.
11. Develop instrument index sheet for P & ID developed in experiment 4.

A) Virtual Lab 1- Project Investment

Text Books:

1. Management systems by John Bacon (ISA).
2. Project Management A System Approach to Planning, Scheduling and Controlling by Harold Kerzner (Van Nostrand Reinhold Publishing).
3. Applied instrumentation in process industries by Andrew & Williams (Gulf Publishing).

References Books:

1. Garold D. Oberlender, “ Project Management for Engineering and Construction “ Mc Grow Hill.
2. Instrument Installation Project Management (ISA).

**Third Year Instrumentation Engineering
Modern Control Theory Lab**

Course Code:	INPCC608	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Practical 50 Marks		

Pre-requisites:

- Basic knowledge of Mathematics , Electrical & Electronics Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Practical	External	50

Course Objectives

1	Develop proficiency in computing the state transition matrix using various techniques, such as Laplace transform, Cayley Hamilton method, and similarity transformation.
2	Students can gain practical experience in applying theoretical concepts of control systems analysis and design to real-world problems

Course Outcomes: Students will be able to

608.1	Improved understanding of transient and steady-state behavior of electrical networks
608.2	Ability to evaluate and compare control system performance
608.3	Proficiency in root locus analysis for stability assessment
608.4	Ability to converting between transfer function and state space models
608.5	Proficiency with state feedback control design
608.6	Competence in designing state observers and implementing state feedback

List of Experiments:

Students are expected to perform any 8 experiments.

Study of Step Response of R-L Network

2. Study of Step Response of R-C Network

3 Study of Time Response of R-L-C Network

4. Study of first and second order system response..

5. Find steady state error of type 0,1,2 system.

6. Stability analysis using root locus approach

7. Conversion of transfer function model to state space and vice-versa..

8. Computation of state transition matrix using different methods

9. Design a state feedback controller through pole placement approach..

10. Design full order state observer using principle of duality.

11. Stability analysis of Lypunuv Functions.

12. Find the Response of the discrete time control system for standard inputs.

13. Determine effect of sampling period on stability of discrete time control system.

Text Books:

1. Control Systems Engineering Author : Nagrath and Gopal Publisher : New Age Publication
2. Modern Control Engineering Author : Katsuhiko Ogata Publisher : Prentice Hall of India
3. Modern Control System Author : Richarc C. Drof and Robert H. Bishop Publisher : 11th Edition Person Int.
4. Automatic Control Systems Author : Benjamin C.Kuo Publisher : Farid Golnaraghi, John Wiley & Sons.

References

1. A. Nagoor Kani, Control System, RBA Publications.
2. M. Gopal , Digital Control & State Variable Methods, TMH..
3. M. Gopal, "Control Systems, Principles and Design", Second Edition, TMH, New Delhi, 2002.

Third Year Instrumentation Engineering Machine Learning Lab			
Course Code:	INPEC609A	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Termwork examination 50 Marks		

Pre-requisites:

- Python programming language.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	50

Course Objectives

1	To explain the fundamental elements of machine learning for classification, regression, clustering.
2	To apply and evaluate the performance of a different machine learning models.

Course Outcomes: Students will be able to

609A.1	Implement different supervised and unsupervised machine learning algorithms.
609A.2	Evaluate performance of machine learning algorithms for real-world applications.

List of Experiments:

Students are required to perform all experiments from the given list.

1. Dataset: <https://www.kaggle.com/datasets/venky73/temperatures-of-india/data>
This data consists of temperatures of INDIA averaging the temperatures of all places month wise. Temperature values are recorded in CELSIUS.
 - a. Apply Linear Regression using suitable library function and predict the Month-wise temperature.
 - b. Assess the performance of regression models using MSE, MAE and R-Square metrics
 - c. Visualize simple regression model.
2. To implement KNN algorithm to predict whether user will purchase the product or not.
Dataset: User_data.csv
3. Predict the onset of diabetes based on diagnostic measures using SVM algorithm.
Dataset: <https://www.kaggle.com/datasets/uciml/pima-indians-diabetes-database/>
The objective of the dataset is to diagnostically predict whether or not a patient has diabetes, based on certain diagnostic measurements included in the dataset.

List of Experiments:

4. To build a machine learning model classifier using Decision tree to predict whether a student will get admission or not.
Dataset: <https://www.kaggle.com/mohansacharya/graduate-admissions>
Apply Machine Learning Algorithm and Evaluate Model.
5. Home price prediction using machine learning.
Dataset: <https://www.kaggle.com/datasets/kunwarakash/chennai-housing-sales-price/data>
6. Iris flower species prediction using Machine Learning.
Dataset: IRIS.csv
7. Breast cancer prediction analysis using Machine Learning
Dataset: <https://www.kaggle.com/datasets/yasserh/breast-cancer-dataset/data>
8. Heart disease prediction using machine learning techniques. Compare the performance of models.
Dataset: <https://www.kaggle.com/datasets/arezaei81/heartcsv>
9. Apply K means clustering algorithms (based on Spending Score) to find the group of customers and evaluate model.
Dataset: <https://www.kaggle.com/shwetabh123/mall-customers>
10. VLAB: Word tokenization (NLP)

Text Books:

1. Machine Learning For Absolute Beginners by Oliver Theobald
2. Python Machine Learning by Sebastian Raschka and Vahid Mirjalili
3. Understanding Machine Learning by Shai Shalev-Shwartz and Shai Ben-David
4. Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013 2.
5. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
6. Tom M. Mitchell, Machine Learning, 1997, McGraw-Hill, First Edition

References Books:

1. Introduction to Machine Learning with Python by Andreas C. Müller, Sarah Guido
2. Machine Learning For Dummies by John Paul Mueller and Luca Massaron
3. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy
4. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
5. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition
6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
7. Shalev-Shwartz S., Ben-David S., Understanding Machine Learning: From Theory to Algorithms, CUP, 2014

**Third Year Instrumentation Engineering
Building Automation Lab**

Course Code:	INPEC609B	Credit	1
Contact Hours:	2 Hrs/week (L)	Type of Course:	Practical
Examination Scheme	Termwork Examination 50 marks		

Pre-requisites:

- Basic knowledge of Sensor Transducer and control system Engineering

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	50

Course Objectives

1	Articulate the purpose and operation of HVAC system components, the operation of HVAC systems.
2	Apply knowledge of thermal comfort conditions and its impact on human comfort, productivity, And health.
3	To make students aware about the construction, operation various features of sensors and transducers.
4	Evaluate importance of fire safety systems
5	Develop and implement preventive maintenance practices and schedules for building automation systems.

Course Outcomes: Students will be able to

609B.1	Define and articulate the fundamental concepts of Building Automation Systems (BAS), including its scope, historical development, and key components.
609B.2	Integrate HVAC systems effectively by applying control strategies and energy management techniques also apply principles of lighting control systems, incorporating daylight harvesting and occupancy sensing.
609B.3	Identify and define critical comfort parameters, including temperature, humidity, air flow, pressure, and air quality and recognize the significance of maintaining optimal comfort levels in indoor environments.
609B.4	Select appropriate AHU types based on established criteria and demonstrate an understanding of energy-efficient design principles.
609B.5	Evaluate and differentiate between centralized and decentralized access control systems. Demonstrate knowledge of various card technologies, including smartcards, proximity cards, and Mi fare cards.
609B.6	Evaluate case studies on energy optimization, identifying successful examples and associated challenges.

Topics covered:

List of Experiments :

Students are expected to perform Minimum 8 Experiments :

1. To study Architecture of BMS & IBMS
2. To study Psychometric chart and various parameters
3. To study different types of Air Handling Units
4. To study various terminal unit systems (CAV, VAV)
5. To study Chilled Water System and loops
6. To study Hot Water System and loops
7. To study FAS loops and classifications
8. To study SLC wiring, loops, classifications
9. To study cause and effect matrix-Fire alarm system
10. To study CCTV System Architecture and types of cameras
11. Design an alarm annunciator for level control system
12. Design an alarm annunciator for a temperature control system

Text Books:

1. HVAC Systems Design Handbook, Fifth Edition by Roger W. Haines
2. HVAC Fundamentals, volume 1 to 3 by James E. Brumbaugh
3. Basics of Air Conditioning by ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0004 for online shopping)
4. Fire Alarm and Detection System: Quick Book by A. Bhatia.
- 5.

Reference Books:

1. All About AHU's by ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0005 for online shopping)
2. Chillers Basics by ISHRAE. Indian Society of Heating, Refrigerating & Air Conditioning Engineers (product code: B0009 for online shopping)

Third Year Instrumentation Engineering Robotics Automation Lab			
Course Code:	INPEC609C	Credit	1
Contact Hours:	2 Hrs/week (P)	Type of Course:	Practical
Examination Scheme	Termwork examination 50 Marks		

Pre-requisites:

- Basic knowledge of sensors//transducers, control system, Matlab/ Msc Adam / Robo Analyser software.

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Termwork	Internal	50

Course Objectives

1	To make students familiar with Sensors & its applications.
2	To impart knowledge of robot drive systems
3	Demonstration of various robotic configurations using industrial robot and Matlab/ Msc Adam / Robo Analyser software.

Course Outcomes: Students will be able to

609C.1	Understand basic concepts of robotics.
609C.2	Select appropriate drive for Robotic applications.
609C.3	Understand the components of robot programming.
609C.4	Develop simple programs to simulate robot movements.

List of Experiments:

Students are required to perform minimum 08 experiments from the given list.

1. Identify and selection of Sensors such as IR sensors, Proximity Sensor, Ultrasonic Sensor, White line sensor, Temperature Sensor, Touch sensor, Tilt Sensor, Accelerometer, Gyroscopic Sensor etc. based on given application
2. Identify and selection of Actuators and related hardware such as DC motor, Servo motor, Stepper Motor, Motor drivers based on application
3. Demonstration of various robotic configurations using industrial robot
4. Design and selection of Gripper / End effector
5. One Programming exercise on lead through programming
6. Use of Matlab/ Robo Analyser for direct and inverse kinematics of simple robot configuration
7. One Industrial visit for Industrial robotic application
8. Demonstration of simple robotic system using Matlab/ MscAdam / RoboAnalyser software
9. Choose the right robot for given manufacturing and non- manufacturing applications

Text Books:

1. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi
2. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
3. Groover M.P.-Automation, production systems and computer integrated manufacturing Prentice Hall of India

References Books:

1. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
2. Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd. , New Delhi, ISBN:987-81-203-3418-2, 2012
3. John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 2009
4. R K Mittal & I. J. Nagrath, Robotics and Control, McGraw Hill Publication, 2015.
5. Mike Wilson, Implementation of Robotic Systems, ISBN: 978-0-124-04733-4
6. www.roboanalyzer.com

E study material: NPTEL Course on Robotics:

- https://onlinecourses.nptel.ac.in/noc19_me74/preview
https://onlinecourses.nptel.ac.in/noc20_de11/preview

Third Year Instrumentation Engineering Mini Project				
Course Code	INELC610	Credit	1	
Contact hours	02 Hrs/week	Type of course	Practical	
Examination scheme	Term work 25 marks			

Fundamental practical Knowledge of:

1. Basic Electronics
2. Electrical Engineering
3. Linear Integrated Circuits
4. Digital Techniques
5. Embedded Systems

Course Assessment methods/tools:

Sr. No.	Course Assessment methods/tools	External/Internal	Marks
1	Term work	Internal	25

Course Objectives

1	To undertake & execute a Mini Project through a group of students
2	To understand the “Product Development Cycle”, through Mini Project.
3	To learn budget planning for the project.
4	To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.

Course Outcomes: Students will be able to

610.1	Planning and implementation of hardware/ software project
610.2	Prepare the budget for hardware requirement .
610.3	Demonstrate the project .
610.4	Work as a team member.

Maximum Group size:

Minimum 1 and maximum 2 students can form a group for the mini project.

Project Type:

It is mandatory to develop prototype hardware system/product along with software, if any.

A) Project development stages:

Sr. No.	Project development stages/steps
1	Topic finalization.
2	Literatures review minimum 10 latest papers. (Elsevier, Springer, IEEE, UGC care etc.)
3	Preparation of specifications of proposed system and tentative block diagram
4	Preparation of Bill of materials.
5	Design of circuits/selection of components, Procurement of components and stage wise implementation and testing on bread board. (Study of data sheets) Software development, if any.
6	Preparation of PCB of the finalized circuit and mounting of components on PCB and its soldering.
7	Testing of circuit on PCB.
8	Design and fabrication of suitable enclosure and outside fittings such as switches, buttons, knobs, meters, indicators, displays etc.
9	Report writing
10	Participation and paper publication/intellectual property rights.

B) Project Report Preparation:

Chapter	Description	Page Nos.
	Cover page	
	Certificate	
	Acknowledgement	
	Abstract	
	Tables (Figures, Abbreviations, etc.)	
1	Introduction of project	
2	Problem statement, objectives of project, Proposed specifications	
3	Product development stages	
4	Literature survey	
5	Block diagram explanation	
6	Hardware design	
6.1	Primary sensing element	
6.1.1	- Selection of components	
6.1.2	- Calculations	
6.2	Signal conditioning circuits	
6.2.1	- First stage	
6.2.2	- Second stage	
7	Software design. (Flowchart, Algorithms etc.)	
8	PCB artwork	
9	Testing procedures	
10	Test results	
11	Enclosure design	
12	Conclusion	
	Bill of material	
Annex.-I	Published paper/certificates.	
Annex.-II	Any special data sheet	

Note 1: Above points in A and B are just guidelines, it may change as per the project type/guide suggestions.

Guidelines for report preparation:

1	1 Printing: A4 size bond paper for report.
2	Spacing between two lines should be 1.5.
3	Margins: Left- 1.25", Right- 1", Top and bottom- 0.75"
4	Font style: Times New Roman
5	Font sizes: Title of the chapter-18, sections- 16, subsections- 14, and the text- 12.
6	All figures, equations and tables must be numbered.
7	Binding: Spiral (Front spiral binding page glossy finish

Third Year Instrumentation Engineering			
FOREIGN LANGUAGE LEVEL-II GERMAN			
Course Code:	INVSE606	Credit:	01
Contact Hours:	1 Hr./Week (L)	Type of Course:	Lecture
Examination Scheme	Term Work 25 Marks		

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives

1	To get introduced to the Culture, Routine of the German Society through language.
2	To meet the needs of ever growing German industry with respect to language support.

Course Outcomes: Students will be able to

6ACA.1	Develop reading, writing and listening skills.
6ACA.2	Use tenses in German Language.
6ACA.3	A Develop interest to pursue a German language course.
6ACA.4	Get an comprehensive understanding of basic German Language and build a good enough vocabulary to articulate themselves in any given daily life situation.

Unit I: Introduction of Cases (06 hrs)

Introduction of Cases: Nominative, Akkusative, Personal & Possessive Pronouns in Nominative, Akkusative

Unit II: Prepositions and Tenses (06 hrs)

Prepositions:- Akkusative

Tenses:- Past tense of sein & haben Verbs . Simple sentences and questions using vocabulary
Formal and informal conversations .

Text Books:

1. “Netzwerk A-1 (Deutsch als Fremdsprache) “ Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. Tipps und Uebungen A1

Online Resources:

1. Practice Material like online Worksheets regarding the Grammar.
2. Nptel Course On German -Ii Language
3. Online German-English Dictionary www.Leo.Org

**Third Year Instrumentation Engineering
Foreign Language Japanese Level 2**

Course Code:	IOHSM6ACB	Credit	1
Contact Hours:	01Hr/Week	Type of Course:	Lecture
Examination scheme:	Term-work 25 marks		

Pre-requisites:

Nil

Course assessment methods/tools:

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work	Internal	25

Course Objectives

1	To understand the basics of the Japanese writing system, including Kanji characters.
2	To indicate an action or motion in progress, describe habitual actions, and express permission and prohibition.

Course Outcomes: Students will be able to

6ACB.1	Demonstrate basic communication skills.
6ACB.2	Describe their daily routines in Japanese.
6ACB.3	Describe things, people, and places using appropriate adjectives.
6ACB.4	Express the existence or presence of a thing or a person in different contexts.

Topics covered:

UNIT I: Kanji Basics (6 hrs.)

Introduction to Kanji Script, Describing one's daily routine. To ask what someone does. Expressions of Giving & Receiving.

Adjectives (Types of adjectives) Asking for an impression or an opinion about a thing / person / place that the listener has experienced, visited, or met, Describing things / person / places with the help of the adjectives.

Expressions of Like & Dislikes. Expressing one's ability. Talking about one's hobbies. Comparison between objects, persons & cities. Audio Learning

UNIT II: Spatial, Action and Progressive Basics (6 hrs.)

Stating existence or a presence of thing (s), person (s) Relative positions,

Introduction to counters - Part II

Expressing one's Desire & wants, Verb groups, Asking, instructing a person to do something. Indicating an action or motion is in progress. Describing habitual action Describing a certain continuing state which resulted from a certain action in the past. Express permission & prohibition. Audio Learning

Text Books:

1. Minna No Nihongo, “Japanese for Everyone”, Elementary Main Textbook 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

Reference Books:

1. George Trombley, Yukari Takenaka “Japanese from Zero!” Learn From Zero Publisher

MOOC/NPTEL courses

1. NPTEL Course on “**JapaniBhasha –SaralSwaroop (Japanese course taught in Hindi) ”**

Link of the Course: https://onlinecourses.nptel.ac.in/noc23_hs76/preview

2. NPTEL Course on ” Introduction to Japanese Language and Culture”

Link of the Course : https://onlinecourses.nptel.ac.in/noc19_hs52/preview

Guidelines for Assessment (Any one of following but not limited to)

- Written Test
- Presentation
- Report