

PROPOSED REVISED CURRICULUM for M.TECH INSTRUMENT TECHNOLOGY

CREDIT REQUIREMENTS

	Credits				
	Program Core (PC)	Program Elective (PE)	Open Elective (OE)	Bridge Course	Total Credits
1st Semester	9	3	-	3	15
2nd Semester	12	3	-	-	15
3rd Semester	6	6	-	-	12
4th Semester	12	-	-	-	12
TOTAL	39 (Including Project 18 Cr)	9	-	3	54

CURRICULUM LAYOUT

Semester	Program Core	Program Elective	Other Courses
1	IDP703 (0-0-6) IDL711 (3-0-0) IDL731 (3-0-0)	PE-1: 3 credits	Bridge course: Any one of the following two IDL601 (For non-electrical students only) IDL603 (For electrical students only)
2	IDP704 (0-0-6) IDL712 (3-0-0) IDL714 (2-0-2) IDL734 (3-0-0)	PE-2: 3 credits	-
3	IDD801 (0-0-12)	PE-3: 3 credits PE-4: 3 credits	-
4	IDD802 (0-0-24)	-	-

LIST OF CORE COURSES

S. No.	Course No.	Title	L-T-P	Credits
1	IDP703	Instrument Technology Laboratory 1	0-0-6	3
2	IDP704	Instrument Technology Laboratory 2	0-0-6	3
3	IDL711	Sensors and Transducers	3-0-0	3
4	IDL712	Electronic Techniques for Signal Conditioning and Interfacing	3-0-0	3
5	IDL714	Instrument Design and Simulations	2-0-2	3
3	IDL731	Optical Components and Basic Instruments	3-0-0	3
7	IDL734	Laser Based Instrumentation	3-0-0	3
8	IDD801	Major Project Part 1	0-0-12	6
9	IDD802	Major Project Part 2	0-0-24	12
Total PC			14-0-50	39

LIST OF BRIDGE COURSES OF THIS PROGRAMME

S. No.	Course No.	Title	L-T-P	Credits
1	IDL601	Electronic Components and Circuits (for non-electrical students only)	3-0-0	3
2	IDL603	Material and Mechanical Design (for electrical students only)	3-0-0	3

LIST OF PROGRAMME ELECTIVES OF THIS PROGRAMME

S. No.	Course No.	Title	L-T-P	Credits
1	IDP705	Advanced Instrument Technology Lab	0-0-6	3
2	IDL722	Precision Measurement Systems	3-0-0	3
3	IDL733	Optical Material and Optical Techniques in Instrumentation	2-0-2	3
4	IDL737	Display Devices and Technology	3-0-0	3
5	IDL740	Instrument Organization and Ergonomics	2-0-2	3
6	IDL811	Selected Topics in Instrumentation-I	3-0-0	3
7	IDL814	Selected Topics in Instrumentation-II	3-0-0	3
8	IDL 815	Special Topics in Instrumentation	1-0-0	1
9	IDC812	Term Paper and Seminar	0-3-0	3
10	IDS720	Independent Study	0-3-0	3

LIST OF PROGRAMME ELECTIVES FROM OTHER PROGRAMME

S. No.	Course No.	Title	L-T-P	Credits
1	PYL790	Integrated Optics	3-0-0	3
2	PYL755	Basic optics and optical Instrumentation	3-0-0	3
3	PYL792	Optical Electronics	3-0-0	3
4	PYL793	Photonic devices	3-0-0	3
5	ELL787	Embedded Systems and Applications	3-0-0	3

6	EEL723	Microprocessor Based Industrial Control	3-0-0	3
7	CRL725	Technology of RF and Microwave Solid State Devices	3-0-0	3
8	ELL746	Biomedical Electronics	3-0-0	3
9	PYL780	Diffraction and Micro optics	3-0-0	3
10	MEL 736 (old)	Instrumentation and Control Engineering	3-0-0	3
11	MEL 705 (old)	Experimental Methods for Mechanical Measurement	3-0-0	3

Semester I

S. No.	Course	Type	L-T-P	Credits
4	Sensors and Transducers	PC	3-0-0	3
2	Optical Components and Basic Instruments	PC	3-0-0	3
3	Instrument Technology Laboratory 1	PC	0-0-6	3
4	Program Elective – I	PE	2-0-2	3
5	Bridge : Any one out of the following two 1. Electronic components and Circuits (For non-electrical students) 2. Material and Mechanical Design (For electrical students only)	Bridge	3-0-0	3
Semester Total			11-0-8	15

Semester II

S. No.	Course	Type	L-T-P	Credits
1	Electronic Techniques for Signal Conditioning and Interfacing	PC	3-0-0	3
2	Laser Based Instrumentation	PC	3-0-0	3
3	Instrument Design and Simulations	PC	2-0-2	3
4	Instrument Technology Laboratory 2	PC	0-0-6	3
5	Program Elective – II	PE	3-0-0	3
Semester Total			11-0-8	15

Semester III

S. No.	Course	Type	L-T-P	Credits
1	Program Elective – III	PE	3-0-0	3
2	Program Elective – IV	PE	3-0-0	3
3	Major Project Part – I	Project	0-0-12	6
Semester Total			3-0-12	12

Semester IV

S.No.	Course	Type	L-T-P	Credits
1	Major Project Part – II	Project	0-0-24	12
Semester Total			0-0-24	12

COURSE TEMPLATE

1.	Department/Centre/School proposing the course	Instrument Design Development Centre		
2.	Course Title	Electronic components and circuits		
3.	L-T-P structure	3-0-0		
4.	Credits	3	Non-graded Units	Please fill appropriate details in S. No. 21
5.	Course number	IDL 601		
6.	Course Status (Course Category for Program) Bridge Course			
	Institute Core for all UG programs		(Yes / No) No	
	Programme Linked Core for:		Nil	
	Departmental Core for:		-	
	Departmental Elective for:		M.Tech. in Instrument Technology	
	Minor Area / Interdisciplinary Specialization Core for:		N/A	
	Minor Area / Interdisciplinary Specialization Elective for:		N/A	
	Programme Core for:		Nil	
	Programme Elective for:		M.Tech. in Instrument Technology	
	Open category Elective for all other programs (No if Institute		(Yes / No) No	

7.	Pre-requisite(s)	MSc (Physics, Engineering in disciplines other than Electronics, Electrical and Instrumentation)
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		Non
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	nil
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	10% with ELL731 10% with ELL 735
8.2	Supersedes any existing course		No

9.	Not allowed for	Engineering in Electronics, Electrical and Instrumentation.
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10.	Frequency of offering (check one box)	☐ Every semester ☒ I sem ☐ II sem ☐ Either Semester
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11.	Faculty who will teach the course	Prof. A.L.Vyas, Prof. D.T.Shahani
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12.	Will the course require any visiting faculty?	(Yes/no) No
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13.	Course objectives The course objective is to familiarize the students with basic electronic components and circuits. After the course the students should be able to design analog, digital and mixed signal circuits for application in Instruments
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Review of Electronic Components: Passive Components, Active Components including components used in Industrial Environment. Electronic Circuits: Choppers, Clampers, analog circuits, precision and instrumentation amplifiers, signal conditioning circuits, industrial electronic circuits. Nonlinear devices and circuits, computing circuits and waveform generators. Analog-Digital circuits: A/D and D/A converters, classification and characteristic parameters of DAC's and ADC's. Testing criteria. Multiplying DAC's. Digital Electronics: Logic gates, Combinational logic design, Sequential logic design, Counters; Memory Devices, SRAM, DRAM, ROM, EPROM, Flash Memories and Programmable Gate Arrays. Microprocessors: 8 bit and 16 bit microprocessor, basic structure and programming. Application of microprocessors in instruments. Introduction to micro-controllers and embedded systems.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Introduction to passive and active components and their characteristics	4
2	Analog circuits using transistors and FETs	5
3	Operational Amplifiers and circuits	5
4	Industrial Electronic circuits	2
5	Nonlinear Circuits and waveform generators	4
6	Logic gates, combinational logics, sequential logic design and counters	5
7	Memory devices, Flash Memories and Programmable Gate Arrays	3
8	A/D and D/A convertors, Characteristics, testing criteria, Multiplying D/A	5
9	Introduction to microprocessors and programming	5
10	Application of microprocessor in Instruments	2
11	Introduction to micro-controllers and embedded systems	2
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
Total Practical / Practice hours (14 times 'P')		

- 18. Brief description of module-wise activities pertaining to self-learning component** (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description	
1-5	Designing of analog circuits using analog components	5 Hrs
6-8	Designing of mixed signal circuits	5 Hrs
9-11	Programming of microprocessor and microcontrollers for specific application	3 Hrs
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)		

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pritice Hall
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2. Donald L. Shilling and Charles Belove, "Electronic Circuits: Discrete and Integrated", McGraw Hill
3. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Applications" New Age Int. Publishers, New Delhi
4. John H. Davis, "MSP430 Microcontroller Basics", Elsevier India Pvt. Limited, New Delhi.

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	-
20.2	Hardware	-
20.3	Teaching aids (videos, etc.)	-
20.4	Laboratory	-
20.5	Equipment	
20.6	Classroom infrastructure	OHP, LCD Projector, White/Black Board
20.7	Site visits	-
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	Eg. 25% of student time of practical / practice hours: sample Circuit Design exercises from industry
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date: _____ (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

1.	Department/Centre proposing the course	Instrument Design Development Centre
2.	Course Title (< 45 characters)	Materials and Mechanical Design
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	IDL603
6.	Status (category for program)	Programme Elective (PE)

7.	Pre-requisites (course no./title)	NO
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8.	Status vis-à-vis other courses (give course number/title)	
8.1	Overlap with any UG/PG course of the Dept./Centre	NO
8.2	Overlap with any UG/PG course of other Dept./Centre	NO
8.3	Supersedes any existing course	NO

9.	Not allowed for (indicate program names)	
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10.	Frequency of offering	☐ Every sem ☒ 1stsem ☐ 2ndsem ☐ Either sem -
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11.	Faculty who will teach the course S P Singh, S R Kale, D. T. Shahani, A. L. Vyas, Gufran Khan, Chandra Shakher	
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12.	Will the course require any visiting faculty? (yes/no)	YES
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13.	Course objectives (about 50 words): The course is designed to provide students from non-mechanical streams the basic understanding of materials, mechanical engineering design and fabrication processes.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Basics of Design: Stresses, strain, hardness, toughness, visco-elasticity, torsion, bending, deflection of beams, combined stresses, energy methods. Material: metals and their alloys, heat treatment, polymers, composites, ceramics etc. Design of machine elements: Failure theories for static and alternating loadings. Design of shafts, fasteners, springs, curved beams, thick and thin vessels, gears etc; Lubrication, journal bearings and rolling contact bearings, limits, fits and tolerances. Deflection of thin plates. Design of mechanical elements for strain gage and other instrumentation applications. Intro-duction to vibrations and its isolation. Mechanical Fabrication techniques used in instruments. Basic mechanical fabrication processes. Design and drawing sessions.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Basics of Design, Basic Drawing reading	05
2	Limits, fits and tolerances.	05
3	Review of Material: metals and their alloys, heat treatment, polymers, composites, ceramics etc	04
4	Review of Stresses, strain, hardness, toughness, visco-elasticity, torsion, bending, deflection of beams	05
5	Lubrication, journal bearings and rolling contact bearings	04
6	Design of mechanical elements for strain gage and other instrumentation applications	04
7	Intro-duction to vibrations and its isolation	05
8	Overview of Mechanical Fabrication techniques used in instruments	05
9	Overview of Basic mechanical fabrication processes related to instrument design	05

COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours

17. Brief description of laboratory activities

Module no.	Description	No. of hours

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1	Drawing exercises	10
2	Search for limits and tolerances in numerous instrument levers and couplings	03

4	Study of stresses in optical elements under mounting stages	06
6	Case studies on mounting of sensors like encoders, potentiometers – linear and rotational etc	03
8	Case studies in mechanical fabrication	06

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Books:

1. Yoder , P.R Opto-Mechanical Systems Design, Third Edition, CRC Press, Taylor & Francis Group, 2005
2. Murty T K : Elements of Mechanical Engineering. , I K International Publishers 2010

20. Resources required for the course *(itemized & student access requirements, if any)*

20.1	Software	
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	
20.4	Laboratory	
20.5	Equipment	
20.6	Classroom infrastructure	

20.7	Site visits	
20.8	Others (please specify)	

21. Design content of the course *(Percent of student time with examples, if possible)*

21.1	Design-type problems	25 % mechanical design related excercises and case studies
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

(Please avoid changing the number of tables, rows and columns or text in dark black, but fill only the columns relevant to the template by editing the columns in grey letters or blank columns: this would help in automating the processing of template information for curricular use)

1.	Department/Centre/School proposing the course	INSTRUMENT DESIGN DEVELOPMENT CENTRE	
2.	Course Title	Instrument Technology Laboratory I	
3.	L-T-P structure	0-0-6	
4.	Credits	3	Non-graded Units
5.	Course number	IDL 703	
6.	Course Status (Course Category for Program) (list program codes: eg., EE1, CS5, etc.) JID		
	Institute Core for all UG programs	(Yes / No)	
	Programme Linked Core for:	M. Tech Instrument Technology	
	Departmental Core for:	M.Tech Instrument Technology	
	Departmental Elective for:	List of B.Tech. / Dual Degree Programs	
	Minor Area / Interdisciplinary Specialization Core for:	Name of Minor Area / Specialization	
	Minor Area / Interdisciplinary Specialization Elective for:	Name of Minor Area / Specialization	
	Programme Core for:	JID	
	Programme Elective for:	List of M.Tech. / Dual Degree Programs of	
	Open category Elective for all other programs (No if Institute Core)	(Yes / No)	

7.	Pre-requisite(s)	NIL
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		(course number)
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	NIL (course number)
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	NIL (course number)
8.2	Supersedes any existing course		NIL (course number)

9.	Not allowed for	(indicate program names) Allowed for any program who have dealt with basic physics of Sensors and Transducers
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10.	Frequency of offering (check one box)	☐ Every semester Yes ☒ I sem ☐ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) D T Shahani, A K Agarwala, A L Vyas, Gufran Khan
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): The program being interdisciplinary, one of the objective of electronics part of the course is to familiarise non-electronic students with test and measurement procedures in electronics. The second objective is to familiarize the students with performance of different type of transducers. The third and most important objective is to familiarize the students with different type of circuits that are mostly used in giving a calibrated electrical output. In this respect the type of experiments are briefly given below. Review of Electronics Test and Measurement Equipment, Characterisation of Sensors – Several Common Transducers, Characterisation of Electronic Subsystems used alongwith transducers. Calibration of numerous common sensors and test specifications of common transducers. In optics part of the course, the objective is to provide basic understanding to measure various parameter like cardinal points, focal length, angle of prisms and wedge plates, radius of curvature, surface Form and Figure error, error estimation by optical techniques, displacement etc which are used to design and develop optical instruments.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): The laboratory essentially supports the courses taught in the first semester courses. It consists of experiments on:- Study of packaging and characterization of transducers used for measurement of different physical variables like displacement, temperature, pressure, strain, flow etc.; Study of practical signal conditioning techniques and electronic measurement methods; Study of Electronic subsystems used in instruments
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	Experiments on Cardinal points measurements using Nodal slide method, Measurement of wedge angle of optical flat and right angle of a prism by Autocollimation, Measurement the long radius of curvature of concave mirror using Foucault Knife edge test and Ronchi test, Newton and Fizeau Interferometer for Testing of optical surface, Quantitative testing of optical elements using polarisation based Twyman-Green interferometer, Measurement of small radius of curvature of lens using “Optical Spherometer”, Moire interferometry for displacement measurement
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
Total Lecture hours (14 times ‘L’)		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	Not applicable	

Total Tutorial hours (14 times 'T')		

17. Brief description of Practical /

Module no.	Description	No. of hours
1	a) Ranging and calibration of a milli-ammeter, and digital panel meter as indicating device in instrumentation. b) Measurement of angular displacement using linear potentiometer (setting span and range) and application of DPM in angular displacement measurement.	06
2	Characterisation of Transducer Bridge Conditioning circuit and to study the application of Instrumentation amplifier in resistance bridges.	06
3	To measure the R-T characteristic of a thermistor and to construct a linearized temperature sensor.	06
4	a) Measurement of thermocouple characteristics. b) Testing its electronic conditioning circuit.	06
5	To design electronic conditioning circuit for a cold junction compensated thermocouple thermometer	03
6	To construct a centigrade thermometer with a sensitivity of $10\text{mV}/^{\circ}\text{C}$ and to measure its performance.	06
7	a) Electronic Conditioning for Capacitance Transducers b) To design a Conductivity measurement system and evaluate its performance.	06
8	To estimate the thermal resistance of a heat sink.	06
9	Cardinal points measurements using Nodal slide method	06
10	Measurement of wedge angle of optical flat and right angle of a prism by Autocollimation	06
11	Measurement the long radius of curvature of concave mirror using Foucault Knife edge test and Ronchi test	06
12	Newton and Fizeau Interferometer for Testing of optical surface	06

13	Quantitative testing of optical elements using polarisation based Twyman-Green interferometer	06
14	Measurement of small radius of curvature of lens using “Optical Spherometer”	06
15	Moire interferometry for displacement measurement	06
Total Practical / Practice hours (14 times 'P')		84

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description	Hours
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)		

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Malacara, D, Optical Shop Testing, Third Edition, John Wiley & Sons Inc., 2007
2. Separate material will be provided for individual measurement systems/equipments
3. Lab manuals for individual experiments. The suggested books for further details are mentioned in the lab manuals

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	M.Tech Optics Lab MDIT Lab
20.5	Equipment	
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of students etc.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

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COURSE TEMPLATE

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1.	Department/Centre/School proposing the course	Name of Department/Centre/School	
2.	Course Title	Instrument Technology Laboratory 2	
3.	L-T-P structure	0-0-6	
4.	Credits	3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDP 704	
6.	Course Status (Course Category for Program) (list program codes: eg., EE1, CS5, etc.) JID		
	Institute Core for all UG programs	(Yes / No)	
	Programme Linked Core for:	List of B.Tech. / Dual Degree Programs	
	Departmental Core for:	List of B.Tech. / Dual Degree Programs	
	Departmental Elective for:	List of B.Tech. / Dual Degree Programs	
	Minor Area / Interdisciplinary Specialization Core for:	Name of Minor Area / Specialization	
	Minor Area / Interdisciplinary Specialization Elective for:	Name of Minor Area / Specialization	
	Programme Core for:	JID	
	Programme Elective for:	List of M.Tech. / Dual Degree Programs	
	Open category Elective for all other programs (No if Institute Core)	(Yes / No) NO	

7.	Pre-requisite(s)	combinations of courses: eg. (XYZ123 & XYW214) / XYZ234 Bridge Course in Electronics for JID (non-Electronics Students), IDP 703, IDL 703, IDL 712
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		(course number) not more than 20 % overlap
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	(course number)
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	(course number)
8.2	Supersedes any existing course		(course number)

9.	Not allowed for	(indicate program names)
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem 2nd ☒ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) D.T.Shahani, A K Agarwala, A L Vyas
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): (i) Understand working of important subsystems like synchronous detectors, level amplifiers, instrumentation amplifiers in measurement applications (ii) Characterize performance of control circuits like temperature, speed etc (iii) Understand Drive circuits for actuators (iv) Do data conversion using ADC DAC, multipliers etc (v) Use microcontrollers for real world interfacing (vi) Appreciate precision measurement methods and metrology (vii) Understand practical issues in calibration and use of standards
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): The laboratory supports the subjects taught in the second semester courses. The laboratory consists experiments on: Study of various techniques used for analog and digital conditioning of signals from various transducers/ detectors; Study on modulation/ demodulation techniques, noise generation and measurement, Study of testing and calibration methods of instruments. The structure of experiments has been designed to impart design level familiarity with various subsystems of instrumentation set up. The subsystems may consist of a detector-transducer, signal conditioner, a level power amplifier, display, actuator/final control element. The study will generally focus attention on one of the subsystems. In electronics conditioning
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	Specific Case Study Experiments as below: Experiments in Control involving speed, position, temperature controls using MATLAB Experiments in Heat Conduction/ Convection. And Heat Sink Characterisatio Data conversion, ADC & DAC, synchronous detectors , multipliers, dividers, instrumentation amplifiers Microprocessor/Microcontroller based system design with emphasis on real world interfacing Experiments on precision measurement methods and metrology.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
Total Lecture hours (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours

1		
2		
3		
4		
5		
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
1	Design and characterisation of active filters, LPF, HPF and BPF	06
2	Electronic Instrumentation Module Impedance Characterisations a) Measurement of complex Z_{in} , and Z_o Testing proper Impedance interfacing with cascaded modules	06
3	Transfer Function Characterisation a) Frequency Domain Time Domain	06
4	To study multiplier chip AD 633, and its use in Electronic conditioning of transducer output	06
5	To study voltage to frequency converters	06
6	To study frequency to voltage converters	06
7	To study phase sensitive detection and to construct a capacitance meter	06
8	To calibrate RPM measurement with reluctance sensor	06
9	To incorporate above in speed control of DC motor	06
10	To calibrate RTD v/s temperature	03
11	To incorporate above in temperature control application	06
12	To study of DSP kits	09
13	Programming of DSP to implement various filters	06

Total Practical / Practice hours (14 times 'P')		84

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Lab manuals for individual experiments. The suggested books for further details are mentioned in the lab manuals

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
20.2	Hardware	Nature of hardware, number of access points, etc.

20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	MDIT
20.5	Equipment	Type of equipment required, number of access points, etc.
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of students etc.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	Eg. 25% of student time of practical / practice hours: sample Circuit Design exercises from industry
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date: _____ (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

1.	Department/Centre/School proposing the course	Instrument Design Development Centre	
2.	Course Title	Advanced Instrumentation Laboratory	
3.	L-T-P structure	0-0-6	
4.	Credits	3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDP 705	
6.	Course Status	Programme Elective	

7.	Pre-requisite(s)	IDP 703
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	-
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	-
8.2	Supersedes any existing course		-

9.	Not allowed for	-	-
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10.	Frequency of offering (check one box)	☐ Every semester ☒ I sem ☐ II sem ☐ Either semester
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11.	Faculty who will teach the course A.L.Vyas, A.K.Agrawalla, D.T.Shahani, G.S.Khan, Chandra Shakher
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): This course will provide students with in depth understanding of electronic circuits and optical sub-systems used for Instrumentation. This course will familiarize students with DSP architecture and its programming for developing DSP based sub-systems/Instruments
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Experiments on design, simulation and verification of instrumentation sub-systems addressing the following objectives: - the performance of practical transducer systems and their processing circuits - dealing with other devices and circuit noise - validation of algorithms for information extraction from sensor signatures - dynamic range, threshold and sensitivity characterization and response time evaluation in practical environments Experiments based on Digital Signal Processing hardware and software to: - study of DSP architecture - interfacing with peripheral components - Implementation of DSP algorithm Experiments based on Talbot effect, Digital Speckle Pattern Interferometry and Shack Hartmann Sensor
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)

	As per requirement-To be specified by the course instructor	
Total Lecture hours (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
1	Characterization of thermister and thermal model	6
2	To study a proportional process temperature controller	6
3	To study a variable reluctance magnetic sensor and to design electronic tachometer	6
4	To construct an electronic speed controller	6
5	To study battery powered data logger	6
6	To study and to carry out circuit design using Operational Amplifiers	6
7	Familiarization with DSP Kit and tools: Running of sample programmes	6
8	Familiarization with DSP Kit and tools: ADC and DAC interfacing	6
9	Real time Implementation of Moving average filter	6
10	Real time Implementation of FIR filter (40 taps)	6

11	Implementation of IIR filter (4 th order)	6
12	Wavefront measurement using Shack-Hartmann Sensor	6
13	Measurement of optical constants using Digital Speckle Pattern Interferometry	6
14	Measurement of in-plane displacement using Talbot interferometry	6
Total Practical / Practice hours (14 times 'P')		84

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description	No. of hours
1	Background study and preparation for experiments 1 to 6	6
2	Study from DSP Processor instruction set manuals	3
3	Assignments	3
4	Lab experiment preparation 6-11	12
5	Filter design using Matlab	6

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Lab Manuals 2. DSP architecture and Instruction set manuals 3. Code composer Studio Manual 4. B. Preetham Kumar, "Digital Signal Processing Laboratory" 2nd Edition, CRC Press, 2010

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Code Composer Studio
20.2	Hardware	Oscilloscopes, Function Generators, DSP Kits
20.3	Teaching aids (videos, etc.)	Power point Presentation
20.4	Laboratory	Laboratory equipped with basic test and measurement facilities
20.5	Equipment	-
20.6	Classroom infrastructure	LCD Projector, White/Black Board
20.7	Site visits	
20.8	Others (please specify)	Nil

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	Electronic circuit design
21.2	Open-ended problems	DSP filter design
21.3	Project-type activity	Nil
21.4	Open-ended laboratory work	Nil
21.5	Others (please specify)	Nil

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

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COURSE TEMPLATE

(Please avoid changing the number of tables, rows and columns or text in dark black, but fill only the columns relevant to the template by editing the columns in grey letters or blank columns: this would help in automating the processing of template information for curricular use)

1.	Department/Centre/School proposing the course	INSTRUMENT DESIGN DEVELOPMENT CENTRE	
2.	Course Title	SENSORS AND TRANSDUCERS	
3.	L-T-P structure	3-0-0	
4.	Credits	3	Non-graded Units
5.	Course number	IDL 711	
6.	Course Status (Course Category for Program) (list program codes: eg., EE1, CS5, etc.) JID		
	Institute Core for all UG programs	(Yes / No)	
	Programme Linked Core for:	M. Tech Instrument Technology	
	Departmental Core for:	M.Tech Instrument Technology	
	Departmental Elective for:	List of B.Tech. / Dual Degree Programs	
	Minor Area / Interdisciplinary Specialization Core for:	Name of Minor Area / Specialization	
	Minor Area / Interdisciplinary Specialization Elective for:	Name of Minor Area / Specialization	
	Programme Core for:	JID	
	Programme Elective for:	List of M.Tech. / Dual Degree Programs of	
	Open category Elective for all other programs (No if Institute Core)	(Yes / No)	

7.	Pre-requisite(s)	combinations of courses: eg. (XYZ123 & XYW214) / XYZ234 Any Btech/ MSc Courses containing "Transducers or Sensors or Test and Measurement" in EE, Electronics, Instrumentation. Mechanical Engg,
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		(course number)
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	NIL (course number)
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	NIL (course number)
8.2	Supersedes any existing course		NIL (course number)

9.	Not allowed for	(indicate program names) Allowed for any program who have dealt with basic physics of Sensors and Transducers
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10.	Frequency of offering (check one box)	☐ Every semester Yes ☒ I sem ☐ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) D T Shahani, A K Agarwala, A L Vyas
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): (i) Understand terminology, and basic concepts of transducers (ii) Understand electronic conditioning requirements transducers – case studies (iii) Appreciate issues of Transducer performance, Calibration standards, Testing (iv) Understand types of errors, noise and effect on resolution, dynamic range (v) Appreciate Transducer Choice – with discussion on common applications (vi) Appreciate basic ideas behind MEMs, Nano Sensors
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Transducer Fundamentals : (i) Transducer terminology (i i) Design and performance characteristics, --- criteria for transducer selection, (iii) Case Studies – Transducers principles of representative cases with emphasis on special "Electronic Conditioning requirements" of different type of sensors-- Resistive transducer; Inductive transducers; capacitive transducers; piezoelectric transducer; semiconductor and other sensing structures. Displacement transducers; tachometers and velocity transducers; accelerometers and gyros; strain gauges; force and torque transducers; flow meters and level sensors; pressure transducers; sound and ultrasonic transducer. Phototubes and photodiodes; photovoltaic and photoconductive cells, photoemission, photo electromagnetic, detectors pressure actuated photoelectric detectors, design and operation of optical detectors, detector characteristics. (iv) Brief Introduction -- Smart Intelligent Sensors, MEMS, Nano (v) Transducer Performance : Static and dynamic performance parameters (vi) Standards : Electrical tests, measurement unit, measurement standards of of voltage, current, frequency, impedance etc
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	(vii) Errors and noise: types of errors, Effect of noise and errors on resolution and threshold. Dynamic range (viii) Testing: Calibration, dynamic tests, environmental test, life test. (ix) Case Studies in Application of transducers: displacement, velocity, acceleration, force, stress, strain, pressure and temperature measurement. Angular and linear encoders, Radar, laser and sonar distance measurement, Tachometers, Viscometer, densitometer.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Transducer terminology -- Review	5
2	Design and performance characteristics of transducers	5
3	Case Studies – principles, special electronic conditions (Passive sensors)	5
4	Case Studies – principles, special electronic conditions (Active sensors)	5
4	Transducer Performance	4
5	Standards, Testing & Calibration	5
6	Errors and noise – influence on resolution and dynamic range	4
7	Case Studies in Application of commonly used transducers	5
8	Basic ideas behind MEMs, Nano Sensors	4
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	Not applicable	
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical /

Module no.	Description	No. of hours
Total Practical / Practice hours (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description	Hours
3, 4	Explore information of additional transducers pertaining to Module 3-4	3
5	Self Study on calibration techniques module 5	6
7	Explore information of additional transducers pertaining to Module 7	6

(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Sinclair "Sensors and Transducers"
A K Sawhney "A course in Electronics Measurements and Transducers"
Ernest Doebinil "Instrumentation Design Studies"

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	Type of facility required, number of students etc.
20.5	Equipment	LCD
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of students etc.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	1) Case studies of Transducer selection for common applications 2) Case studies on Calibration of Sensors
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		3) Case Studies of Electronics Conditioning Circuits
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date: (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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COURSE TEMPLATE

(Please avoid changing the number of tables, rows and columns or text in dark black, but fill only the columns relevant to the template by editing the columns in grey letters or blank columns: this would help in automating the processing of template information for curricular use)

1.	Department/Centre/School proposing the course	Name of Department/Centre/School IDDC	
2.	Course Title	(< 45 characters) Electronic Techniques for Signal Conditioning and Interfacing	
3.	L-T-P structure	L-T-P 3-0-0	
4.	Credits	(L+T+P/2) 3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDL 712	
6.	Course Status (Course Category for Program) (list program codes: eg., EE1, CS5, etc.) JID		
	Institute Core for all UG programs		(Yes / No)
	Programme Linked Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Elective for:		List of B.Tech. / Dual Degree Programs
	Minor Area / Interdisciplinary Specialization Core for:		Name of Minor Area / Specialization
	Minor Area / Interdisciplinary Specialization Elective for:		Name of Minor Area / Specialization
	Programme Core for:		List of M.Tech. / Dual Degree Programs JID
	Programme Elective for:		List of M.Tech. / Dual Degree Programs EE,
	Open category Elective for all other programs (No if Institute Core)		(Yes / No)

7.	Pre-requisite(s)	combinations of courses: eg. (XYZ123 & XYW214) / XYZ234 Introductory Electromagnetics course (Bachelors level in Physics or EE) AND IDL 711, OR Bridge Course in Electronics in JID OR Network theory –
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8.	Status vis-à-vis other courses	
8.1	List of courses precluded by taking this course (significant overlap)	(course number) Not more than 20 % overlap with any pre-requisite
	(a) Significant Overlap with any UG/PG course of the Dept./Centre/ School	(course number)
	(b) Significant Overlap with any UG/PG course of other Dept./Centre/ School	(course number)
8.2	Supersedes any existing course	(course number)

9.	Not allowed for	(indicate program names)
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem 2nd ☒ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) D. T. Shahani, A K Agarwala, A L Vyas
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): (i) Do basic circuit design of HF circuits with S parameters (ii) Design electronic conditioning modules for various transducers (iii) To appreciate requirements of ultra-precision electronic conditioning (iv) Appreciate signal interfacing requirements in terms of single ended, double ended, signals, input and output impedances etc (v) Issues regarding EMI/EMC for hardening of electronic modules against electromagnetic interference (vi) Understand concepts of proper grounding, shielding (vii) Prepare equivalent circuits for noise sources – electric field, magnetic field, common mode voltages etc (viii) Understand data conversion analog to digital, vice versa, V-F, F-V etc (ix) Review of multiplexing, microcontroller applications in instrumentation, dataloggers
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities):
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	Review of Network theory, transmission lines and Circuit parameters (Z Y Hybrid, etc) and introduction to HF Design and S parameters Analog signal conditioning, Ultra- precision conditioning, Gain; attenuation; input and output impedances; single ended and differential signals; CMRR; system-module interfacing consideration; measurement and characterization of electronic system modules. Analog and digital System Co-housing: EMI effects and EMC measures; circuit card placement; shielding and grounding techniques; ground loop management; isolation and interference filtering. EMI hardening and EMC interfacing. Analog and digital data transmission; modulation & demodulation; Data transmission; channel noise and noise immunity factors. Data busses; GPIB and other standards in parallel data transmission. Opto-electronic interfacing techniques. Analog and digital representation of data; comparisons and relative merits; multiplexing and demultiplexing of analog and digital data, ADC/DAC. Microcontroller and DSP applications. Application of CPU's in signal and data handling; response linearization and drift compensation; data logger, computer aided measurement and control.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Review of Network Theory	3
2	HF Design and S-parameters	5
3	Signal Conditioning – including ultra precision	5
4	Module interfacing considerations	3
5	EMI sources and EMI Noise Equivalent circuit	4
6	EMI Hardening Measures	4
7	Interfacing issues in Data Transmission (analog and digital)	5
8	Review – Data Conversion - ADC/DACs	3
9	Microcontroller and DSP applications in Instrument Technology	5
10	Computer Aided Measurement and Control – Interfacing issues	5

Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	No tutorial	
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
	Covered in IDP 703, and IDP 705	
Total Practical / Practice hours (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
3	Exercises in errors induced due to limitations in practical instrumentation circuits
5	Development of Noise equivalent Circuits in specific Cases
6	Solutions to EMI Hardening in specific Cases
10	Case studies in Control Applications
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Valkenberg , "Network Analysis" –, Prentice Hall
Donald, White "Electromagnetic Interference and Compatibility"
Instrumentation Amplifier – Handbook – Burr Brown Corporation

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	Type of facility required, number of students etc.
20.5	Equipment	Type of equipment required, number of access points, etc.
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of students etc.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	1) Students asked to solve typical problems of susceptibility to noise, EMI hardening, HF design and Instrumentation Amplifier, and cabling types in Interfacing 2) Practicals in IDP 704 and IDP 705 – optional (but recommended for JID students)
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

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COURSE TEMPLATE

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1.	Department/Centre/School proposing the course	Name of Department/Centre/School IDDC		
2.	Course Title	(< 45 characters) Instrument Design and Simulations		
3.	L-T-P structure	2-0-2		
4.	Credits	(L+T+P) 3	Non-graded Units	Please fill appropriate details in S. No. 21
5.	Course number	IDL 714		
6.	Course Status (Course Category for Program) (list program codes: eg., EE1, CS5, etc.)			
	Institute Core for all UG programs		(Yes / No)	
	Programme Linked Core for:		List of B.Tech. / Dual Degree Programs	
	Departmental Core for:		List of B.Tech. / Dual Degree Programs	
	Departmental Elective for:		List of B.Tech. / Dual Degree Programs	
	Minor Area / Interdisciplinary Specialization Core for:		Name of Minor Area / Specialization	
	Minor Area / Interdisciplinary Specialization Elective for:		Name of Minor Area / Specialization	
	Programme Core for:		List of M.Tech. / Dual Degree Programs JID	
	Programme Elective for:		List of M.Tech. / Dual Degree Programs EE,	
	Open category Elective for all other programs (No if Institute Core)		(Yes / No)	

7.	Pre-requisite(s)	combinations of courses: eg. (XYZ123 & XYW214) / XYZ234 Introductory Electromagnetics course (Bachelors level in Physics or EE) AND IDL 711, OR Bridge Course in Electronics in JID OR Network theory –
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8.	Status vis-à-vis other courses		
	8.1	List of courses precluded by taking this course (significant overlap)	(course number) Not more than 20 % overlap with any pre-requisite
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	(course number)
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	(course number)
	8.2	Supersedes any existing course	(course number)

9.	Not allowed for	(indicate program names)
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem 2nd ☒ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) A K Agarwala, A L Vyas
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): Use simulation techniques to evaluate the performance of an instrument circuit or system and obtain useful feedback on how the performance of the system can be enhanced
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Review of circuit analysis and design. Review of signals and systems in time and frequency domain: Fourier and Laplace Transforms, response plots. Dynamic properties of instrument systems: Review of instrument control systems, on-off, proportional and PID controllers. Stability considerations, gain and phase margin. Use of pulse and harmonic test signals for performance evaluation. Linear modelling of instrument systems. Models for basic instrument building blocks. Simulation studies of circuit blocks. Simulation studies of circuits, instrument modules, transducers and control schemes using PSPICE and MATLAB expert simulation software.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Review of circuit analysis and design techniques	3
2	PSPICE models of circuit components	5
3	Response plots in frequency and time domain using simulation. Introduction to Real time transient simulations using linear and pulsed stimuli	5
4	Simulation techniques for analog circuits using PSPICE	3
5	Introduction to Analog Behavioral Models for Circuits and Sensors	5
6	Introduction to MATLAB and it's capabilities including toolboxes	5
7	Simulink as a graphical simulation environment	2
Total Lecture hours (14 times 'L')		28

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	Not applicable	
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
2	Entering own circuits into PSPICE using component libraries	6
3	Saving and editing simulated response plots with word processors	4
5	Behavioural modeling of thermistors and thermocouples	6
7	Creating MATLAB Simulink models from primitives	6
6	Running MATLAB simulations	6
Total Practical / Practice hours (14 times 'P')		28

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
2	Practice creating device models of bipolar transistors and MOSFETS
4	Create behavioral models for different transducers
6	Study use of two toolboxes of your choice in MATLAB
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

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Orcad PSPICE user Manual
MATLAB user manual available online on the IITD website

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	ORCAD 9.2 20 licenses, MATLAB 10 LICENSES
20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	Table and chairs for 25 students with a power point at each work station for charging laptops
20.5	Equipment	50" wall mounted LED screen with remote and provision to connect to desktop or laptop computer
20.6	Classroom infrastructure	Seating for 25 student s with slide projector.
20.7	Site visits	None
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	1. Design of audio and radio frequency amplifier spanning the frequency range of 20KHz to 300MHz 2. Design of amplitude regulated audio and rf amplifiers 3. Design of conducted noise EMI filters 20% time
21.2	Open-ended problems	
Solution	Project-type activity	Study MATLAB solutions to harness solar energy 20% time
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

1.	Department/Centre/School proposing the course		INSTRUMENT DESIGN DEVELOPMENT CENTRE	
2.	Course Title	PRECISION MEASUREMENT SYSTEMS		
3.	L-T-P structure	3-0-0		
4.	Credits	3	Non-graded Units	NA
5.	Course number	IDL 722		
6.	Course Status (Course Category for Program) Bridge Course			
	Institute Core for all UG programs		NO	
	Programme Linked Core for:		Nil	
	Departmental Core for:		-	
	Departmental Elective for:		M.Tech. in Instrument Technology, JID	
	Minor Area / Interdisciplinary Specialization Core for:		N/A	
	Minor Area / Interdisciplinary Specialization Elective for:		PHYSICS	
	Programme Core for:		Nil	
	Programme Elective for:		M.Tech Instrument Technology, JID	
	Open category Elective for all other programs (No if Institute		NO	

7.	Pre-requisite(s)	NIL
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		Non
(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School		NIL
(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School		10% with PHL836 (old number)
8.2	Supersedes any existing course		No

9.	Not allowed for	NIL
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem ☒ II sem ☐ Either Semester
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11.	Faculty who will teach the course GUFRAN SAYEED KHAN, CHANDRA SHAKHER. P. SENTHILKUMARAN, D.S.MEHTA
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12.	Will the course require any visiting faculty?	NO
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13.	Course objectives This course focuses teaching on precision measurement techniques used in scientific and industrial applications. Statistical data analysis, post processing and error estimation analysis is taught. The course covers different mechanical and optical methods of precise testing with an emphasis on fundamental design principles of precision systems and their achievable accuracies.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Fundamentals of precision measurements: accuracy, precision, resolution, repeatability, reproducibility, consistency, drift analysis, dynamic range, Measurements and error estimation, systematic and random errors, Instrument transfer function, least square method and its applications, filtering, polynomial fitting, data analysis and statistical inference, correlation, Surface roughness, waviness and shape measurements, Study of some measurement systems such as mechanical and optical profilers, circularity, cylindricity and conicity measurement systems, Co-ordinate measuring machine, profile projector, long trace slope measuring profilometer, Shack-Hartmann sensor for slope measurement, Different Interferometers for optical metrology, absolute testing techniques, Moire techniques for measurements in industrial applications
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Introduction to precisions measurement: accuracy, precision, resolution,	05

	repeatability, reproducibility, consistency, drift analysis,	
2	Measurements and error estimation, systematic and random errors, Instrument transfer function and its dynamic range	04
3	Least square method and its applications, spatial filtering, polynomial fitting, data analysis and statistical inference, correlation analysis	04
4	Surface topography, surface roughness, waviness and shape measurements,	04
5	Mechanical and optical profilometers, circularity, cylindricity and conicity measurement systems,	04
6	Co-ordinate measuring machine, Profile projector, tool makers microscope	04
7	Slope measurement systems; Long trace slope measuring profilometer and Shack-Hartmann sensor for slope measurement,	05
8	Different Interferometers (Michelson, Fizeau, Twyman-Green, Shearing) for optical metrology	05
9	Absolute interferometric testing techniques	02
10	Moire techniques for measurements in industrial applications	05
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
1-2		
Total Practical / Practice hours (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description	
2-3	Developing/ learning statistical analysis tools for data processing	5 Hrs
4	Coherence correlation interferometry for surface texture	4 Hrs
7	Applications of slope measuring systems in adaptive optics	4 Hrs
8-9	N-position and reconstruction methods of quasi-absolute testing	5 Hrs
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)		

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Whitehouse, D.J, Handbook of Surface and nanometrology, Institute of Physics Publishing, 2003
2. Malacara, D, Optical Shop Testing, Third Edition, John Wiley & Sons Inc., 2007
3. Separate material will be provided for individual measurement systems/equipments

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20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	-
20.2	Hardware	-
20.3	Teaching aids (videos, etc.)	-
20.4	Laboratory	-
20.5	Equipment	
20.6	Classroom infrastructure	OHP, LCD Projector, White/Black Board
20.7	Site visits	-
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	15 % in statistical data analysis
21.2	Open-ended problems	NIL
21.3	Project-type activity	10%
21.4	Open-ended laboratory work	NIL
21.5	Others (please specify)	NIL

Date: _____ (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

(Please avoid changing the number of tables, rows and columns or text in dark black, but fill only the columns relevant to the template by editing the columns in grey letters or blank columns: this would help in automating the processing of template information for curricular use)

1.	Department/Centre/School proposing the course	Instrument Design Development Centre	
2.	Course Title	Optical Components and Basic Instruments	
3.	L-T-P structure	3-0-0	
4.	Credits	3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDL731	
6.	Course Status (Course Category for Program) Programme Elective (PE)		
	Institute Core for all UG programs		(Yes / No)
	Programme Linked Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Core for:		Instrument Design Development Centre
	Departmental Elective for:		
	Minor Area / Interdisciplinary Specialization Core for:		Name of Minor Area / Specialization
	Minor Area / Interdisciplinary Specialization Elective for:		Physics
	Programme Core for:		List of M.Tech. / Dual Degree Programs
	Programme Elective for:		List of M.Tech. / Dual Degree Programs
	Open category Elective for all other programs (No if Institute Core)		(Yes / No)

7.	Pre-requisite(s)	NO
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		NO
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	NO
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	20% (Basic Optics and Optical Instrumentation)
8.2	Supersedes any existing course		NO

9.	Not allowed for	(indicate program names)
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10.	Frequency of offering (check one box)	☐ Every semester ☒ I sem ☐ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) Prof. Chandra Shakher, Dr. Gufran Khan, Prof. Dalip Singh Mehta and Prof. Senthilkumaran P.
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12.	Will the course require any visiting faculty?	NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): The objective of the course is to provide students the fundamental knowledge about the imaging characteristics of optical systems. In addition to this, the course deals with the design characteristics of refracting optical elements, diffracting optical elements, polarizing optical elements and different kinds of prisms which are used in different optical systems/instruments. Basic instruments like telescopes, microscopes, interferometers and systems like cystoscopies and periscopes are also covered.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Generation of light: Thermal, non-thermal and semiconductor light sources. Measurement of light and instrumentation, Properties and propagation of light; The Ray Optics, Wave Optics, and Electromagnetic Optics; Basics of interference, diffraction and polarization of light. Optical Components: Reflecting components, plane, Spherical, paraboloidal, total internal reflection. Refracting components; Converging, diverging and combination of lenses, Design analysis and image formation by lenses, Wavefront aberrations; Monochromatic (Seidel), and chromatic aberrations. Eyepieces: Huygens, Ramsden, and special eyepieces; Prisms, Polarizing prisms: Glan Taylor Polarizer, Glan- Thomson prism polarizer, Rochon Prism Polarizer, Senarmont prism polarizer, Wollaston Prism, Phase plates ($\lambda/2$, $\lambda/4$), Soleil – Babinet compensator, Diffracting components; diffraction by single/multiple/openings, types of gratings and fabrication techniques, diffractive optical elements. Polarizing components; Polarization by reflection, and double refraction, birefringence crystals, and polarization based optical devices, Rotatory Polarization, Polarization rotators; Optical instruments: Microscopes, Telescopes, cystoscope; Refracting, reflecting, interferometric telescopes. Interferometers; two- beam, multiple-beam, and
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	shearing interferometers; Detectors: Photodetectors, CCD and CMOS detectors, IR-detectors.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Generation of light, properties of light, and geometrical optics	5
2	Wave Optics: Basics of Interference, diffraction, polarization	5
3	Image formation and Aberration in optical systems	5
4	Diffraction optical elements	5
5	Polarizing optical elements	5
6	Prisms: Dove, Porro, Rhomboids, Penta, Amici, right angle, roof etc.	5
7	Optical instruments-I: microscope, telescope, combination of telescopes and microscopes (endoscopes and cystoscopes)	5
8	Optical instruments-II: Interferometers, two-beam, multiple-beam, and shearing interferometers	5
9	Detectors	2
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours

Total Tutorial hours (14 times 'T')	
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17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
Total Practical / Practice hours (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
3	Correction of Chromatic aberration using diffractive optics
4	Fabrication Techniques of Diffractive optical elements
6	Dispersion Correction by using Amici Prism
7	Uses of optical instruments in medical applications
8	Temperature measurement using Mach-Zehnder interferometers

(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Smith, W.J., Modern Optical Engineering, International Edition, McGraw-Hill, 1991

Sirohi R.S. and Kothiyal M.P., Optical Components, Systems and Measurement Techniques, Marcel Dekker Inc., 1991

Jenkins F. and White H., Fundamentals of Optics, 4th Edition, McGraw-Hill, 2001

Hecht E., Optics, 3rd Edition, Addison-Wesley, 2002

Hariharan P., Basics of Interferometry, 2nd Edition, Academic Press, 2006

Ghatak A., Optics 1st Edition, McGraw-Hill, 2009

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	Type of facility required, number of students etc.
20.5	Equipment	Type of equipment required, number of access points, etc.
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of students etc.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	10%
21.2	Open-ended problems	15%
21.3	Project-type activity	2%
21.4	Open-ended laboratory work	NIL
21.5	Others (please specify)	2%

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

1.	Department/Centre/School proposing the course	INSTRUMENT DESIGN DEVELOPMENT CENTRE		
2.	Course Title	OPTICAL MATERIALS AND OPTICAL TECHNIQUES IN INSTRUMENTATION		
3.	L-T-P structure	2-0-2		
4.	Credits	3	Non-graded Units	NA
5.	Course number	IDL 733		
6.	Course Status (Course Category for Program) Bridge Course			
	Institute Core for all UG programs			NO
	Programme Linked Core for:			Nil
	Departmental Core for:			-
	Departmental Elective for:			M.Tech. in Instrument Technology, JID
	Minor Area / Interdisciplinary Specialization Core for:			N/A
	Minor Area / Interdisciplinary Specialization Elective for:			PHYSICS
	Programme Core for:			Nil
	Programme Elective for:			M.Tech Instrument Technology, JID
	Open category Elective for all other programs (No if Institute			NO

7.	Pre-requisite(s)	NIL
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		Non
(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School		NIL
(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School		10% with PHP 763(old number)
8.2	Supersedes any existing course		No

9.	Not allowed for	NIL
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10.	Frequency of offering (check one box)	☐ Every semester ☒ I sem ☐ II sem ☐ Either Semester
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11.	Faculty who will teach the course GUFRAN SAYEED KHAN, CHANDRA SHAKHER. P. SENTHILKUMARAN, D.S.MEHTA
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12.	Will the course require any visiting faculty?	NO
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13.	Course objectives The optical instruments require optics with different materials. The first part of the course provides the introduction of optical materials and their properties used in UV, visible and iR applications. It includes the manufacturing process of optical glass, plastic optics, and metal optics. The second part of the course provides students the understanding of optical techniques used in the design and development of optoelectronic instrumentation.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Optical materials: Optical and mechanical characteristics of optical glass, metal optics, plastic optics and optical crystals, Manufacturing of optics on optical glass and plastics, Injection molding of plastic optics, Single point diamond turning and CNC milling and micromachining, replication techniques Photo-Lithography and its optical system, Illumination and projection systems, Astronomical and remote sensing systems, detectors: Thermal detectors, photon detectors and Imaging detectors
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Introduction to basic characteristics of optical materials, Optical glass, Polymer/plastic optics and metal optics	05
2	Manufacturing methods of optical glass, plastic optics and metal optics,	05

	single point diamond turning, micromilling, deterministic polishing	
3	Molding of plastics and glasses, replication techniques	03
4	Photo-lithography and its optical system,	04
5	Detectors: Thermal detectors, photon detectors and Imaging detectors	04
6	Illumination and projection systems	04
7	Astronomical and remote sensing systems	03
Total Lecture hours (14 times 'L')		28

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
1	Hands-on experience on manufacturing techniques of optical elements	12
2	Homogeneity and residual stress/strain measurement in optical materials	04
3	Hardness measurement of optical materials	04
4	Measurement of sensitivity and thickness of thin film using electro-optics sensor	04
5	Refractive index measurement of solids and liquids	04

Total Practical / Practice hours (14 times 'P')		28

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
1	Selection of optical material for given system 5 Hrs
2	Reading on Magnetorheological Finishing and waterjet polishing 5 Hrs
3	Optical System Requirement for Wall projectors 5 Hrs
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Karow H.H, Fabrication methods for precision optics, John Wiley & Sons Inc. 1993
2. Hradyanath, R, Optical workshop Technology, Tata McGraw-Hill, 1993
3. Weber, M J, Handbook on Optical Materials, Wiley, 2002
4. Simmons, J.H, Optical materials, Wiley, 2000
5. Wakaki, M, Optical materials and applications, Wiley, 2012

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	-
20.2	Hardware	-
20.3	Teaching aids (videos, etc.)	-
20.4	Laboratory	-
20.5	Equipment	

20.6	Classroom infrastructure	OHP, LCD Projector, White/Black Board
20.7	Site visits	-
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	15 % in material selections
21.2	Open-ended problems	NIL
21.3	Project-type activity	10%
21.4	Open-ended laboratory work	NIL
21.5	Others (please specify)	NIL

Date: _____ (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

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1.	Department/Centre/School proposing the course	IDD Centre	
2.	Course Title	Laser Based Instrumentation	
3.	L-T-P structure	3-0-0	
4.	Credits	3	Non-graded Units
5.	Course number	IDL 734	
6.	Course Status (Course Category for Program) PC		
	Institute Core for all UG programs	(Yes / No)	
	Programme Linked Core for:		
	Departmental Core for:	M.Tech / Instrument Technology	
	Departmental Elective for:	Physics	
	Minor Area / Interdisciplinary Specialization Core for:		
	Minor Area / Interdisciplinary Specialization Elective for:		
	Programme Core for:	M.Tech / Instrument Technology	
	Programme Elective for:	Physics	
	Open category Elective for all other programs (No if Institute Core)	(Yes / No)	

7.	Pre-requisite(s)	NO
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		(course number)
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	NIL
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	12% overlap with Laser Systems and Applications (Physics Dept.) 20% overlap with Fourier optics and Holography (physics Dept.)

8.2	Supersedes any existing course	NO
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9.	Not allowed for	NIL
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem ☒ II sem ☐ Either semester
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11.	Faculty who will teach the course Prof. Chandra Shakher, Dr. Gufran S. khan, Prof. D. S. Mehta and Prof. P. Senthilkumaran
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): To provide students the understanding of generation of LASER and the state of the art applications of different properties of LASER in scientific and industrial measurements. Some examples of applications are measurement of straightness and alignments of large electrical machines, measurement /monitoring of vibrations, measurements/monitoring of temperature, measurements of material constants. In addition to this, the course deals with the holography and its applications in 3D imaging and optical metrology. Holographic optical elements and their properties used in industrial instruments/systems.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Radiation and matter interaction and fundamental of LASER action. The LASER and it's properties. Laser systems - gas and semiconductor LASERS. LASER beam optics and propagation of LASER beams. Fundamentals of holography - basic theory of holography, recording medium and type of holograms for display purposes. Applications of holography in metrology - Holographic Interferometry, double exposure, time averaged and real time holographic interferometry. Laser speckles and laser speckles techniques. Digital speckle pattern interferometry (DSPI) and digital holographic interferometry (DHI) in measurements of displacement, refractive index, temperature, shape, vibration and material properties. Two wavelength and phase-shifting interferometry. Laser based temperature measurement techniques. Collimation testing and laser based alignment systems. Laser based techniques for low frequency and high frequency vibration measurements. Talbot interferometry and its applications in scientific and
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	industrial measurements. Shearing interferometry and its applications in scientific and industrial measurements. Sensing of high currents on high voltage lines using magneto optic effect.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Generation of laser light and some typical examples of laser system	5
2	Properties of laser light including derived properties	5
3	Fundamentals of holography - basic theory of holography, recording medium and type of holograms for display purposes.	4
4	Applications of holography in metrology - Holographic Interferometry, double exposure, time averaged and real time holographic interferometry	4
5	Applications of Holographic interferometry in optical metrology for displacement measurements, surface profiling, stress – strain analysis and measurement/monitoring of vibrations	4
6	DSPI and digital holographic system and their applications	5
7	Collimation testing and laser based alignment systems	5
8	Laser based techniques for low frequency and high frequency vibration measurements	4
9	Talbot interferometry and its applications in scientific and industrial measurements	2
10	Shearing interferometry and its applications in scientific and industrial measurements	2
11	Sensing of high currents on high voltage lines using magneto optic effect	2
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours

Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
Total Practical / Practice hours (14 times '2.64')		

18. Brief description of module-wise activities pertaining to self-learning component (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
1	Semiconductor Lasers
2	Application of lasers in welding, cutting, drilling and in eye surgery
2	Laser scanners/ Super market scanners
2	Laser Tweezers
4	Encryption by holography and digital holography, Holographic Data Storage
4	Holographic optical elements (HOEs) and their applications in defense and industry

6	Digital Holography for Medical Imaging,
6	Role of CCD and CMOS for conversion of optical signal to electrical signal
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. R. J. Coolier, Optical Holography, Academic Press, Orlando, Fl. (1971).
2. Holographic Non Destructive Testing, Edited By R. K. Erf., Academic Press New York (1974).
3. Holographic Recording Materials (Topics in Applied Physics, edited by H. M. Smith, Springer (1977).
4. Speckle metrology edited by R. K. Erf, Academic Press INC. London, (1978).
5. Handbook of Optical Metrology, Edited by H. J. Caufield, Academic Press Newyork (1979).
6. Speckle Metrology Ed. R. S. Sirohi, publisher Marcel Dekker, Inc. (USA), (1993).
7. P. Hariharan, Optical Holography: Principles, techniques and applications, Cambridge University Press, Newyork (1996).
8. Optical Measurement Techniques and Applications edited by P. K. Rastogi, Artech House, Incorporated (1997)
9. John F. Ready, Industrial applications of Lasers, academic Press, 2nd Edition (1997).
10. Digital Speckle Pattern Interferometry and Related Techniques, Edited by P. K. Rastogi, Wiley, Chichester (2001)
11. P. Hariharan, Basics of Holography, Cambridge University Press (2002),

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	Type of facility required, number of students etc.
20.5	Equipment	Type of equipment required, number of access points, etc.
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of

		students etc.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	5%
21.2	Open-ended problems	15%
21.3	Project-type activity	2%
21.4	Open-ended laboratory work	Nil
21.5	Others (please specify)	Demonstrations – 5%

Date: (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

(Please avoid changing the number of tables, rows and columns or text in dark black, but fill only the columns relevant to the template by editing the columns in grey letters or blank columns: this would help in automating the processing of template information for curricular use)

1.	Department/Centre/School proposing the course	IDDC	
2.	Course Title	INFORMATION DISPLAY DEVICES AND TECHNOLOGIES	
3.	L-T-P structure	3-0-0	
4.	Credits	3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDL 737	
6.	Course Status (Course Category for Program) (list program codes: eg., EE1, CS5, etc.) JID		
	Institute Core for all UG programs		(Yes / No)
	Programme Linked Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Elective for:		List of B.Tech. / Dual Degree Programs
	Minor Area / Interdisciplinary Specialization Core for:		Name of Minor Area / Specialization
	Minor Area / Interdisciplinary Specialization Elective for:		Name of Minor Area / Specialization
	Programme Core for:		JID
	Programme Elective for:		List of M.Tech. / Dual Degree Programs of
	Open category Elective for all other programs (No if Institute Core)		(Yes / No)

7.	Pre-requisite(s)	NIL
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		(course number)
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	NIL (course number)
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	NIL (course number)
8.2	Supersedes any existing course		NIL (course number)

9.	Not allowed for	(indicate program names) Allowed for any program who have dealt with basic physics of Sensors and Transducers
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10.	Frequency of offering (check one box)	☒ 1st semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) Dr. D. S. Mehta, Dr. Aloka Sinha, Dr. G. S. Khan.
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): The aim of the course is to provide knowledge and develop understanding about the areas of various kinds of advanced display materials, devices and technologies. To give exposure and develop awareness about the advanced information display devices and technologies and their applications. At the end of the course the students will achieve knowledge about the materials, devices, fabrication processes, instruments and operating principles of modern information display devices and technologies.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Human vision. Basics of luminescence, fluorescence, and phosphorescence. Display materials and their characterization. Emissive displays: Review of cathode ray tube (CRT) displays. Plasma display devices and technologies, field-emissive, electro-chromic and photo-chromic displays. Inorganic, organic and polymeric LED based display devices: Device physics, materials, fabrication processes, structures, and drive circuits. Electro-optical characterization of LEDs. Transparent thin film (TFTs) displays, electronics, and manufacturing technologies and applications. Non-emissive displays: basics of liquid-crystal materials, their properties and characterization. Liquid-crystal display devices and technologies. Transmissive, reflective, active and passive matrix, thin-film transistor (TFT), transreflective, and back lighting technologies for LCDs. Electronic-ink, electronic paper, and flexible and transparent display technologies and their applications. Laser based projection displays Display electronics and digital light processing technologies. Three-dimensional (3-D) imaging and display technologies: Micro-displays, STEREOSCOPIC 3D displays. HOLOGRAPHIC 3-D
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	displays. Laser based 3D-TV.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Human vision, basics of luminescence, fluorescence, and phosphorescence.	3
2	Fundamentals of liquid-crystal materials, properties, components and devices.	4
3	Liquid-crystal display devices and technologies: transmissive, reflective, passive and active matrix, and thin-film transistor (TFT) technology for LCD. Back lighting technologies for LCDs.	4
4	Field-emissive, electro-chromic, and photo-chromic displays.	3
5	Basic principles and applications of plasma display devices and technologies.	3
6	Light-emitting diode (LED) based display devices: Device physics, materials, fabrication processes, and device structures.	4
7	Organic and polymeric light emitting diodes (OLEDs/PLEDs) based display devices: Device physics, materials, fabrication processes, and device structures. Electro-optical properties of LEDs, display electronics and manufacturing technologies and applications.	5
8	Electronic-ink, electronic paper (e-paper) and flexible display technologies and their applications.	3
9	Display electronics and digital light processing technologies	3
10	Laser based projection displays, digital micromirror devices (DMD) and pico-projectors	3
11	Three-dimensional (3-D) display technologies: Microdisplays, STEREOSCOPIC 3D displays, integral imaging, polarization based 3D-displays.	4
12	HOLOGRAPHIC 3-D displays and laser based 3D-TV.	3

Total Lecture hours(14 times 'L')	42
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16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	Not applicable	
Total Tutorial hours(14 times 'T')		

17. Brief description of Practical /

Module no.	Description	No. of hours
Total Practical / Practice hours(14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description	Hours
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(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. W. den Boer, Active Matrix Liquid Crystal Displays: Fundamentals and Applications, 1st Ed., Newnes, 2005. 2. T. J. Nelson, and J. R. Wullert, Electronic information display and technologies, Vol. 1, World Scientific Pub Co. Inc., 1997. 3. E. Fred Schubert, Light-Emitting Diodes, Cambridge University Press, 2003. 4. Shin-Tson Wu, and Deng-Ke Yang, Fundamentals of Liquid Crystal Devices, Wiley, 2006. 5. Shin-Tson Wu and Deng-Ke Yang, "Reflective Liquid-crystal displays", Wiley 2001. 6. A. Zukauskas, M. S. Shur, and R. Gaska, Introduction to Solid-State Lighting, Wiley-Interscience, 2002. 7. Z. Li and Hong Meng, Organic Light-Emitting Materials and Devices, Vol. III, 2006. 8. Joseph A. Castellano, Handbook of Display Technology, 1st , Ed. Academic Press, 1992. 9. Hari Singh Nalwa, Lauren Shea Rohwer, Ed. "Handbook of Luminescence, Display Materials and Devices," (American Scientific Publishers, Los Angeles, California, USA (2003). 10. W. M. Yen, and S. Shionoya, Phosphor Handbook, CRC Press, 1st , Ed. 1998.
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20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	Name of software, number of licenses, etc.
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20.2	Hardware	Nature of hardware, number of access points, etc.
20.3	Teaching aids (videos, etc.)	Description, Source , etc.
20.4	Laboratory	Type of facility required, number of students etc.
20.5	Equipment	Type of equipment required, number of access points, etc.
20.6	Classroom infrastructure	Type of facility required, number of students etc.
20.7	Site visits	Type of Industry/ Site, typical number of visits, number of students etc.
20.8	Others (please specify)	

21. Design content of the course(Percent of student time with examples, if possible)

21.1	Design-type problems	Eg. 25% of student time of practical / practice hours: sample Circuit Design exercises from industry 4)
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

(Please avoid changing the number of tables, rows and columns or text in dark black, but fill only the columns relevant to the template by editing the columns in grey letters or blank columns: this would help in automating the processing of template information for curricular use)

1.	Department/Centre/School proposing the course	M.Tech (Instrument Design), IDD Centre	
2.	Course Title	Instrument Organization and Ergonomics	
3.	L-T-P structure	2-0-2	
4.	Credits	3 Credits	Non-graded Units
			Please fill appropriate details in S. No. 21
5.	Course number	<Dept Code>L/P/D/S/R/V<No.>	
6.	Course Status (Course Category for Program) : ID		
	Institute Core for all UG programs		(Yes / No)
	Programme Linked Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Core for:		List of B.Tech. / Dual Degree Programs
	Departmental Elective for:		List of B.Tech. / Dual Degree Programs
	Minor Area / Interdisciplinary Specialization Core for:		Name of Minor Area / Specialization
	Minor Area / Interdisciplinary Specialization Elective for:		Name of Minor Area / Specialization
	Programme Core for:		List of M.Tech. / Dual Degree Programs
	Programme Elective for:		List of M.Tech. / Dual Degree Programs
	Open category Elective for all other programs (No if Institute Core)		(Yes / No)

7.	Pre-requisite(s)	combinations of courses: eg. (XYZ123 & XYW214) / XYZ234
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		(course number)
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	(course number)
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	(course number)
8.2	Supersedes any existing course		(course number)

9.	Not allowed for	(indicate program names)
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem ☒ II sem ☐ Either semester
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11.	Faculty who will teach the course (Minimum 2 names for core courses / 1 name for electives) S K Atreya
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12.	Will the course require any visiting faculty?	(Yes/no)
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13.	Course objectives To enable Instrument Designers to organize instruments within the system and outside for interface with the user and with the environment.
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Functions of instrument systems, classification of tasks as man-machine systems, need analysis, product specifications, solutions search, product planning, systems break-up. Strengths and weaknesses of the machines. Understanding the potentials and weaknesses of the human beings, application of force, load lifting, load carrying, stride patterns. Functions of controls and displays, handles, levers, knobs, switches, dials, LCD screens. Hand-held devices, workstations, large control systems. Identification of constraints emerging from scientific, technical, production, environmental and maintenance considerations. Aesthetics of color, form and graphics. Value engineering. Design of manuals, job-aids and training aids. Case studies, Exercises & Projects
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
1	Functions of instrument systems, classification of tasks as man-machine systems, need analysis, product specifications, solutions search, product planning, systems break-up. Strengths and weaknesses of the machines.	2
2	Understanding the potentials and weaknesses of the human beings, application of force, load lifting, load carrying, stride patterns.	8
3	Functions of controls and displays, handles, levers, knobs, switches, dials, LCD screens. Hand-held devices, workstations, large control systems.	8
4	Identification of constraints emerging from scientific, technical, production, environmental and maintenance considerations.	2
5	Aesthetics of color, form and graphics. Value engineering. Design of manuals, job-aids and training aids.	4
6	Case studies, Exercises & Projects	4
Total Lecture hours (14 times 'L')		28

16. Brief description of tutorial activities:

Module no.	Description	No. of hours

Total Tutorial hours (14 times 'T')	
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17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
1	Man-machine analysis	4
2	Load and force experiments	8
3	Control Panel Organization Exercises	4
4	Aesthetics and Form Exercises	4
5	Case Studies, Exercises & Projects	8
Total Practical / Practice hours (14 times 'P')		28

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
1	Case Studies of Instruments
2	Man-machine analysis studies
3	Study of Control Panels
4	Studies of forms and aesthetics
5	Evolving methods and theory

(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Text book: John H. Burgess – “Designing for Humans: The Human Factor in Engineering” Research Journal Applied Ergonomics Claudio Becchetti, Alessandro Neri, - “Medical Instrument Design And Development” Nufert Handbook – “Design & Architecture Standards” Gravriel – “Handbook of Human factors and Ergonomics” Benetton Color Style File Amanda Berrett – “Corporate image” Dr S.K.Sharma, Savita Sharma – “Work Studies and Ergonomics”

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	CAD Software
20.2	Hardware	CAD Workstations,
20.3	Teaching aids (videos, etc.)	Slides, Videos by Design Council UK
20.4	Laboratory	Ergonomics Laboratory , Model making Workshop
20.5	Equipment	Load Cell, Tread Mill, Ergometer, Dynamometer, Goniometer.
20.6	Classroom infrastructure	LCD Projector,
20.7	Site visits	Studies in culture pattern, Design and graphics. Studies of industry and users.
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	20% Exploration and Innovation
21.2	Open-ended problems	20% Analysing a new situation
21.3	Project-type activity	30% Design Projects and exercises

21.4	Open-ended laboratory work	30% Developing prototypes
21.5	Others (please specify)	

Date: (Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate	
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The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

1.	Department/Centre/School proposing the course	Instrument Design Development Centre	
2.	Course Title	Selected Topics in Instrumentation -I	
3.	L-T-P structure	3-0-0	
4.	Credits	3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDL 811	
6.	Course Status	Programme Elective	

7.	Pre-requisite(s)	To be specified by course instructor as per the course contents
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	-
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	-
8.2	Supersedes any existing course		-

9.	Not allowed for	(indicate program names) -
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10.	Frequency of offering (check one box)	☐ Every semester ☒ I sem ☐ II sem ☐ Either semester
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11.	Faculty who will teach the course Prof . A.L.Vyas, Prof Chandra Shakher, Prof D.T.Shahani, Prof. S.P.Singh
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): To impart specialized knowledge with reference to Instruments
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Advanced course on Selected Topics in Instrumentation to the M.Tech. Instrument Technology Programme
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
	As per requirement-To be specified by the course instructor	42
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
Total Practical / Practice hours (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component (Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
	As per the requirements of the selected topics in the course up to 10 Hours
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

To be announced by the course instructor as per the requirement of the topics of the course.
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20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	-
20.2	Hardware	-
20.3	Teaching aids (videos, etc.)	Power point Presentation
20.4	Laboratory	-

20.5	Equipment	-
20.6	Classroom infrastructure	LCD Projector, White/Black Board
20.7	Site visits	At least one industry visit
20.8	Others (please specify)	Nil

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	Will depend on the course topics
21.2	Open-ended problems	Will depend on the course topics
21.3	Project-type activity	Will depend on the course topics
21.4	Open-ended laboratory work	Nil
21.5	Others (please specify)	Nil

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

The information on this template is as on the date of its approval, and is likely to evolve with time.

COURSE TEMPLATE

1.	Department/Centre/School proposing the course	Instrument Design Development Centre	
2.	Course Title	Selected Topics in Instrumentation -II	
3.	L-T-P structure	3-0-0	
4.	Credits	3	Non-graded Units Please fill appropriate details in S. No. 21
5.	Course number	IDL 814	
6.	Course Status	Programme Elective	

7.	Pre-requisite(s)	To be specified by course instructor as per the course contents
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8.	Status vis-à-vis other courses		
8.1	List of courses precluded by taking this course (significant overlap)		
	(a)	Significant Overlap with any UG/PG course of the Dept./Centre/ School	-
	(b)	Significant Overlap with any UG/PG course of other Dept./Centre/ School	-
8.2	Supersedes any existing course		-

9.	Not allowed for	(indicate program names) -
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10.	Frequency of offering (check one box)	☐ Every semester ☐ I sem ☒ II sem ☐ Either semester
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11.	Faculty who will teach the course Prof . A.L.Vyas, Prof Chandra Shakher, Prof D.T.Shahani, Prof. S.P.Singh
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12.	Will the course require any visiting faculty?	(Yes/no) NO
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13.	Course objectives (about 50 words. "On successful completion of this course, a student should be able to..."): To impart specialized knowledge with reference to Instruments
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14.	Course contents (about 100 words; Topics to appear as course contents in the Courses of Study booklet) (Include Practical / Practice activities): Advanced course on Selected Topics in Instrumentation to the M.Tech. Instrument Technology Programme
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours (not exceeding 5h per topic)
	As per requirement-To be specified by the course instructor	42
Total Lecture hours (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Total Tutorial hours (14 times 'T')		

17. Brief description of Practical / Practice activities

Module no.	Description	No. of hours
Total Practical / Practice hours (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-learning component

(Only for 700 / 800 level courses) (Include topics that the students would do self-learning from books / resource materials: Do not Include assignments / term papers etc.)

Module no.	Description
	As per the requirements of the selected topics in the course up to 10 Hours
(The volume of self-learning component in a 700-800 level course should typically be 25-30% of the volume covered in classroom contact)	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

To be announced by the course instructor as per the requirement of the topics of the course.

20. Resources required for the course (itemized student access requirements, if any)

20.1	Software	-
20.2	Hardware	-
20.3	Teaching aids (videos, etc.)	Power point Presentation

20.4	Laboratory	-
20.5	Equipment	-
20.6	Classroom infrastructure	LCD Projector, White/Black Board
20.7	Site visits	At least one industry visit
20.8	Others (please specify)	Nil

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	Will depend on the course topics
21.2	Open-ended problems	Will depend on the course topics
21.3	Project-type activity	Will depend on the course topics
21.4	Open-ended laboratory work	Nil
21.5	Others (please specify)	Nil

Date:

(Signature of the Head of the Department/ Centre / School)

Date of Approval of Template by Senate

The information on this template is as on the date of its approval, and is likely to evolve with time.