PG Diploma (Course Structure)

Subject: Electronics **2 Semester (1 Year Program)**

Semester-I			
Subject Code	**Subject**	**Credit**	**Marks**
CC-11	Analog and Digital Circuit Design	6	100
CC-12	Sensor and Transducers	6	100
PC-11	Lab 1: Analog and Digital Circuits	4	100
PC-12	Lab 2: Sensor and Transducers	4	100
	Internship/ Apprenticeship/ Seminar	2	100
Semester-II			
CC-21	Operational Amplifier and Linear Integrated Circuits	6	100
CC-22	Data Communication and Networking	6	100
PC-21	Lab 1: Operational Amplifier	4	100
PC-22	Lab 2: Data Communication	4	100
	VAC (EESC)	2	100

Part A Introduction				
Program: PG Diploma	**Class : M.Sc.**	**Year: I (ISEM.)**	**Session: 2025-26**	
Subject: ELECTRONICS				
1	**Course Code**	**CC11**		
2	**Course Title**	**Analog and Digital Circuit Design (Paper I)**		
3	**Course Type (Core Course/ Discipline Specific Elective/)**	**Core Course**		
4	**Pre-requisite (if any)**	**To study this course a student must have a Bachelor's degree with Electronics/ Physics as major or minor subject.**		
5	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** **1. Understand the history and application of Semiconductors.** **2. Develop ability to analyse different biasing circuits.** **3. Understand the fundamental concepts of digital electronics.** **4. Understand the basic principle of A/D and D/A Conversion.** **5. Able to analyse and design combinational and logic circuits.**		
6	**Credit Value**	**6**		
7	**Total Marks**	Max. Marks: 40+60=100	Min. Passing Marks:16+24=40	

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week): 6 Lectures (in hours per week)

Unit	Topics	No. of Lectures (1 Hour Each)
I	Contribution of Rishi Kanad in discovery of atom, Contribution of Jagdish Chandra Bose in wireless communication and his work on Cats Whiske. Semiconductors: intrinsic and extrinsic semiconductors, p-n junction, Diode as rectifiers, Zener Diode, applications, avalanche diode, Light Emitting Diode (LED). Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Current Gain, Input and Output Characteristics of CB, CE and CC Configurations. **Activities:** 1. Construct a circuit using available Analog/ Digital components/ devices and prepare a chart/ graph to illustrate that circuit. 2. Visit to an Electronic industry/ Research Laboratory (if possible)/ Prepare a poster to illustrate combinational / sequential circuit.	**18**
II	Field Effect Transistors (FET): Types of FET, JFET. MOSFET, types of MOSFETs, Depletion type MOSFET and Enhancement type MOSFET. Silicon Controlled Rectifier (SCR), Uni Junction Transistor (UJT), DIAC, TRIAC, GTO, Inverter.	**18**

	Activities: 1. Prepare a Chart Illustrating the symbol, output characteristics, and uses of JFET, MOSFET, UJT, SCR. 2. Component Identification: Provide different electronics components and ask students to identify the component and its properties.	
III	Number System, Binary Coded Decimal (BCD), Complements (1's and 2's), Signed and unsigned numbers, Gray Codes. Boolean algebra, Boolean laws. De Morgan's theorem, simplification of Boolean expressions-SOP and POS. Logic gates: AND, OR, NOT, Derived logic gates. Universal property of NOR and NAND gates. **Activities:** 1. Peer Teaching: Ask students to select any topic of choice from given unit and elaborate it for peer group. 2. Create a table that shows the logic gates and its IC numbers.	**18**
IV	Combinational logic analysis and design: Multiplexers and Demultiplexers, Adder (half and full) and their use as subtractor, Encoder and Decoder, Code Converter (Binary to BCD and vice versa). Sequential logic design: Latch, Flip flop (FF), S-R FF, J-K FF, T and D type FFs, clocked FFs, registers, Counters (ripple, synchronous and asynchronous, ring, modulus) **Activities:** 1. Hands on practice: using different gate build circuit for adder and subtractor. 2. Ask students to prepare presentation on Flip Flops.	**18**
V	Analog to Digital (A/D) Converter: Sampling, quantization, encoding, Succussive Approximation (SAR), dual slop ADC, Flash type ADC. Digital to Analog Converter: Binary weighted resistor. R-2R ladder type DAC. 8 and 12-bit ADC/DAC ICs, sample and hold circuit. **Activities:** 1. Problem Solving: Prepare a paper for students having numerical related to A/D and D/A converter.	**18**

	2. Set up a spontaneous discussion on several topics from the units above.	

Keywords/Tags: Diode, SCR, Gates, Flip Flops, Converters.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Maharshi Kanada - Indian Physicist Who First Discovered the Atom, Physics History.
2. Unsung Genius: A Life of Jagadish Chandra Bose, Kunal Ghosh, Aleph Book Company.
3. Applied Electronics: R.S. Sedha, S. Chand and Company Limited.
4. Basic Electronics: B.L. Thereja, S Chand.
5. Digital Design: Morris Mano, Prentice Hall India, New Delhi.
6. Fundamentals of Digital Circuits: A. Anand Kumar, PHI.

Suggested equivalent online courses:

https://onlinecourses.nptel.ac.in/noc22_ee55/preview
https://onlinecourses.swayam2.ac.in/nou23_ec05/preview
https://www.udemy.com/course/analog-electronics-from-basics-to-advanced-electronics/
https://onlinecourses.nptel.ac.in/noc20_ee45/preview
https://www.coursera.org/specializations/semiconductor-devices

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks : 100

Continuous Comprehensive Evaluation (CCE) :40 Marks University Exam (UE): 60 Marks

Internal Assessment : Continuous Comprehensive Evaluation (CCE):**40**	Class Test Assignment/Presentation	**20** **20**
External Assessment : University Exam Section:**60** Time : **03:00 Hours**	**Section(A)** : Very Short Questions **Section (B) :** Short Questions **Section (C) :** Long Questions	**5X1=5** **5X4=20** **5X7=35** **Total=60**

Any remarks/ suggestions:

Part A Introduction				
Program: PG Diploma		**Class : M.Sc.**	**Year: I (ISEM.)**	**Session: 2025-26**
Subject: ELECTRONICS				
1	**Course Code**	**CC12**		
2	**Course Title**	**Sensors and Transducers (Paper II)**		
3	**Course Type (Core Course/ Discipline Specific Elective/)**	**Core Course**		
4	**Pre-requisite (if any)**	**To study this course a student must have a Bachelor's degree with Electronics/ Physics as major or minor subject.**		
5	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** **1. Understand the basics of measurement system with history behind it.** **2. Demonstrate displacement sensors and transducers.** **3. Understand the principle behind strain measurement.** **4. Choose suitable sensor for pressure measurement.** **5. Design different types of temperature sensors.**		
6	**Credit Value**	**6**		
7	**Total Marks**	Max. Marks: 40+60=100	Min. Passing Marks:16+24=40	

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week): 6 Lectures (in hours per week)

Unit	Topics	No. of Lectures (1 Hour Each)
I	Contribution of Lagadha Muni in development of methods for time measurement, Contribution of Scientist George Joseph in the field of remote sensing technology. Basics of measuring instruments, classification of instruments, static and dynamic characteristic of instruments, error and its types, Sensor and Transducer: classification of sensors, sensor calibration techniques, selection of sensors, Measurement of displacement using Potentiometer, & Optical Encoder. **Activities:** 1. Construct a measurement system using any sensor. 2. Compare two different sensors for similar entity and prepare a comparison chart.	**18**
II	Motion Sensors: Resistive strain gauge, Linear Variable Differential Transducer (LVDT), Rotary Variable Differential Transducer (RVDT), Capacitive transducer, piezo electric transducer. **Activities:** 1. Give two lists to students one having different types of sensor and other having applications tell students to patch the correct pair.	**18**

	2. Set up open conversation about real-world sensor uses.	
III	Measurement of strain gauges and materials, Gauging techniques, Strains gauge circuits, Temperature compensation, applications, measurement of vibration and analysis vibration sensing devices, signal conditioners, shock measurements, vibration exciters and calibrations. **Activities:** 1. Identification of different sensors: arrange different types of real sensor and ask students to identify them. 2. Construct a small circuit using Sensor	**18**
IV	Measurement of pressures, Diagrams and elastic elements, transduction methods, Force balance transducers, Solid state devices. Thin film pressure transducers, Piezoelectric pressure transducers, Pressure multiplexes, pressure calibration measurement of flow-flow meters, mass flow measurements. **Activities:** 1. Peer Teaching: Ask students to select different topics from above units and elaborate it for peer group. 2. Arrange a quiz relate to sensor for students.	**18**
V	Measurement of temperature, Temperature sensors and calibration, Measurement of temperature using Thermistor, Thermocouple & RTD, force and torque measurements, Load cell, Digital force transducers, electric weighing system, Phototubes, Photodiodes, phototransistors and Photovoltaic sensors. **Activities:** 1. Prepare Presentations on different topics related to Sensors. 2. Visit to an Electronic industry/ Research Laboratory (if possible).	**18**
Keywords/Tags: Sensor, Transducer, Temperature, Pressure, Strain gauge.		

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. The Time Keepers of the Vedas (History of the Calendar of The Vedic Period, From Rigveda to Vedanga Jyotisa), Prabhakar Gondhalekar, Manohar Publishers and Distributors.
2. George Joseph (Scientist), DBpedia.
3. A.K. Sawhney “Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai and Sons.
4. Understanding Collapse, Guy D. Middleton, Cambridge University Press.

5. DVS Murthy, Transducers and Instrumentation, PHI.
6. Instrumentation, Devices & Systems: Rangan, Sarma and Mani, Tata McGraw Hills
7. Sensors and Transducers: M. J. Usher and D. A. Keating, Red Globe Press, London.

Suggested equivalent online courses:
https://onlinecourses.nptel.ac.in/noc23_ee105/preview
https://onlinecourses.nptel.ac.in/noc23_ee95/preview
https://www.coursera.org/learn/sensors-circuit-interface
https://onlinecourses.swayam2.ac.in/arp20_ap41/preview

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE) :40 Marks University Exam (UE): 60 Marks

Internal Assessment : Continuous Comprehensive Evaluation (CCE):**40**	Class Test Assignment/Presentation	**20** **20**
External Assessment : University Exam Section:**60** Time : **03:00 Hours**	**Section(A)** : Very Short Questions **Section (B) :** Short Questions **Section (C) :** Long Questions	**5X1=5** **5X4=20** **5X7=35** **Total=60**

Any remarks/ suggestions:

<table>
<tr><th colspan="5">Part A Introduction</th></tr>
<tr><td colspan="2">Program: PG Diploma</td><td>Class: M.Sc.</td><td>Year: I (I Sem.)</td><td>Session: 2025-26</td></tr>
<tr><td colspan="5">Subject: Electronics</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="3">PC11</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Analog and Digital Circuit Design (Lab-I)</td></tr>
<tr><td>3</td><td>Course Type (Core Course/ Discipline Specific Elective/)</td><td colspan="3">Practical Course</td></tr>
<tr><td>4</td><td>Pre-requisite (if any)</td><td colspan="3">-</td></tr>
<tr><td>5</td><td>Course Learning outcomes (CLO)</td><td colspan="3">On successful completion of this course, the students will be able to:
1. Recognize the components and related experiment and accessories like CRO, signal generator required to perform the experiment.
2. Perform experiments for understanding the behaviour of the devices.
3. Implement applications of combinational & sequential logic circuits
4. Plot I-V characteristics and draw inferences from it.
5. Prepare Laboratory Record of all the experiments performed.</td></tr>
<tr><td>6</td><td>Credit Value</td><td colspan="3">4</td></tr>
<tr><td>7</td><td>Total Marks</td><td colspan="2">Max. Marks: 40+60=100</td><td>Min. Passing Marks: 16+24=40</td></tr>
<tr><th colspan="5">Part B- Content of the Course</th></tr>
<tr><td colspan="5">Total No. of Lectures-Tutorials-Practical (in hours per week): 2 hours per credit per week
L-T-P: 120 Hrs</td></tr>
<tr><td colspan="4">Lab Assignments
1. Study of the I-V Characteristics of PN Diode and Zener Diode.
2. Study of the I-V Characteristics of BJT in CE, CB, CC configuration.
3. Study of the I-V Characteristics of JFET.
4. Study of the I-V Characteristics of MOSFET.
5. To verify and design AND, OR, NOT gates.
6. To verify and design XOR gates using NAND gates.
7. Design Half and Full Adder, Half Subtractor and Full Subtractor Using logic gates
8. To Study performance of 4:1 multiplexer and 1:4 demultiplexer using</td><td>120 Hrs</td></tr>
</table>

logic gates 9. To build Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type). **10.** Design a shift register and study Serial and parallel shifting of data.	

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. **Analog Electronics Circuits Laboratory Manual, Farzin Asadi, Springer.**
2. **Electronics Practical, A. K. Mittal, Computech Publication Ltd.**
3. **Digital Electronics Lab Manual, Abraham M. Michelen, Pearson.**

Suggested equivalent online courses:

https://de-iitr.vlabs.ac.in
https://ade-iitr.vlabs.ac.in/
https://be-iitkgp.vlabs.ac.in/

Part D-Assessment and Evaluation

Suggested continuous Evaluation Methods:

Internal Assessment (A):	**40 Marks**
Lab Record/ Class Interaction/ Quiz	**15**
Attendance in the Lab.	**10**
Assignments (Technology Dissemination (e.g. training of common online citizen services or software tools to elderly persons/ Industrial Training (10 hours)/ mini project (including coding + project + demo + report))	**15**
External Assessment	**60 Marks**
Viva Voce Practical	**30**
Experiments	**30**
Total Marks (A+B)	**100 Marks**
Any remarks/ suggestions:	

Part A Introduction				
Program: PG Diploma		**Class: M.Sc.**	**Year: I (I Sem.)**	**Session: 2025-26**
Subject: Electronics				
1	**Course Code**	**PC12**		
2	**Course Title**	**Sensor and Transducers (Lab-II)**		
3	**Course Type (Core Course/ Discipline Specific Elective/)**	**Practical Course**		
4	**Pre-requisite (if any)**	**-**		
5	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** **1. Recognize the components and related experiment and accessories like CRO, signal generator required to perform the experiment.** **2. Demonstrate displacement sensors and transducers.** **3. Use pressure sensors and transducers for specific applications.** **4. Understand the necessary precautions to be taken while for performing the experiments.** **5. Prepare Laboratory Record of all the experiments performed.**		
6	**Credit Value**	**4**		
7	**Total Marks**	Max. Marks: 40+60=100	Min. Passing Marks:16+24=40	

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week): 2 hours per credit per week
L-T-P: 120 Hrs

Lab Experiments	
1. To measure displacement using inductive pick-up. 2. To Measure displacement using Potentiometric transducer. 3. To Study optical sensors. 4. To Study temperature sensors. 5. Measurement of Impact using piezoelectric sensor. 6. Measurement of Pressure transducer. 7. Measurement of Displacement using strain gauge. 8. To Measure Displacement using LVDT.	**120 Hrs**

9. To Measure intensity of light using optical transducers.	

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

4. **Transducers and Instrumentation, DVS Murthy, PHI.**
5. **Sensors and Transducers, Dr.K.B.Bhaskar , R.Kumaresan, ARS Publications.**
6. **Measurement and sensor system, Alexander W. Koch, Springer.**

Suggested equivalent online courses:

https://sl-coep.vlabs.ac.in/
https://sil-coep.vlabs.ac.in/List%20of%20experiments.html
https://sl-coep.vlabs.ac.in/

Part D-Assessment and Evaluation

Suggested continuous Evaluation Methods:

Internal Assessment (A):	**40 Marks**
Lab Record/ Class Interaction/ Quiz	**15**
Attendance in the Lab.	**10**
Assignments (Technology Dissemination (e.g. training of common online citizen services or software tools to elderly persons/ Industrial Training (10 hours)/ mini project (including coding + project + demo + report))	**15**
External Assessment	**60 Marks**
Viva Voce Practical	**30**
Experiments	**30**
Total Marks (A+B)	**100 Marks**
Any remarks/ suggestions:	

Part A Introduction				
Program: PG Diploma		**Class : M.Sc.**	**Year: I (IISEM.)**	**Session: 2025-26**
Subject: ELECTRONICS				
1	**Course Code**	**CC21**		
2	**Course Title**	**Operational Amplifier and Linear Integrated Circuits (Paper-I)**		
3	**Course Type (Core Course/ Discipline Specific Elective/)**	**Core Course**		
4	**Pre-requisite (if any)**	**To study this course a student must have a Bachelor's degree with Electronics/ Physics as major or minor subject.**		
5	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** **1. To understand history of semiconductors and analyse basics of operational amplifier.** **2. Explain feedback mechanism in Op-Amp.** **3. Describe various applications of Op-Amp.** **4. Design and analyse different oscillator circuits.** **5. Illustrate Regulated power supply with different types of regulator IC.**		
6	**Credit Value**	**6**		
7	**Total Marks**	Max. Marks: 40+60=100	Min. Passing Marks:16+24=40	

Part B- Content of the Course		
Total No. of Lectures-Tutorials-Practical (in hours per week): 6 Lectures (in hours per week)		
Unit	**Topics**	**No. of Lectures** (1 Hour Each)
I	Contribution of Samarendra Kumar Mitra in development of India's first indigenous analog Computer, Contribution of Prof. S.P. Chakravarti in the field of Electronics and communication. Differential amplifier and its types, Operational Amplifier, Block diagram representation of a typical Op-amp, schematic symbol, characteristics of an Op-amp, ideal op-amp, equivalent circuit, ideal voltage transfer curve, open loop configuration, differential amplifier, inverting & non –inverting amplifier, Op-amp with negative feedback. **Activities:** 1. Organize a debate on the topic: Future of semiconductor in India. 2. Prepare a chart of 741/ 555 IC to illustrate its specifications and applications	**18**
II	Voltage series feedback amplifier, Voltage shunt feedback amplifier, DC and AC amplifiers, summing, scaling and averaging amplifiers, voltage to current converter (Low voltage DC voltmeter and low voltage AC voltmeter only), integrator, differentiator, basic comparator, zero-crossing detector, Schmitt trigger.	**18**

	Activities: 1. Circuit debugging: Provide students with a faulty circuit and ask them to identify the fault. 2. Component Testing: provide students with a variety of components and ask them the test all those components using multimeter.	
III	Application of Op-Amp, Active filters, advantages, First & Second Order: low pass, high pass, band pass, band reject, all pass Butterworth filters, State Variable and bi-quad filters, Impedance converters, switched capacitor filters, special purpose amplifiers. **Activities:** 1. Organise a quiz on Operational Amplifier and its applications. 2. Prepare a comparison chat for low pass, high pass, band pass, band stop filter.	**18**
IV	Theory of oscillation, Relaxation Oscillators, Bootstrap Oscillators, Sine wave oscillator, LM566C Voltage controlled oscillator, The LM 555 Timer controller, the ICL 8038 single chip function generator, LM565 Phase Locked loop. **Activities:** 1. Class teaching: give different topics from above units and tell students to take a class on selected topic. 2. Open Discussion on different types of Oscillators.	**18**
V	Linear Power Supplies: Rectifier circuits Regulations, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators, Op-Amp regulators, IC 723 general purpose regulator, Monolithic switching regulator, **Activities:** 1. Assemble 5V regulated power supply on bread board. 2. Differentiate between types of regulators.	**18**
Keywords/Tags: Differential Amplifier, Operational Amplifier, Active Filters, Oscillators, Regulators.		

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Samarendra Kumar Mitra – the man who built India's first computer! - Get Bengal story.
2. Prof. S.P. Chakravarti (1904–1981), Taylor & Francis Journal.
3. Op-Amps & Linear Integrated Circuits: Ramakant Gaikwad, Prentice Hall of India.
4. The Story of Semiconductors, John W. Orton, OUP Oxford.
5. Operational Amplifiers and their Applications: Subir Kumar Sarkar, S Chand.
6. Linear Integrated Circuits: D Roy Choudhury, Shail Bala Jain, New Age International Publishers.
7. Integrated Circuits K R Botkar, Khanna Publishers, New Delhi.

Suggested equivalent online courses:
https://onlinecourses.nptel.ac.in/noc23_ee65/preview
https://www.classcentral.com/course/swayam-integrated-circuits-mosfets-op-amps-and-their-applications-10006
https://www.udemy.com/course/operational-amplifier-and-its-applications
https://www.udemy.com/course/opamp-and-linear-integrated-circuits

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE) :40 Marks University Exam (UE): 60 Marks

Internal Assessment : Continuous Comprehensive Evaluation (CCE):**40**	Class Test Assignment/Presentation	**20** **20**
External Assessment : University Exam Section:**60** Time : **03:00 Hours**	**Section(A)** : Very Short Questions **Section (B) :** Short Questions **Section (C) :** Long Questions	**5X1=5** **5X4=20** **5X7=35** **Total=60**

Any remarks/ suggestions:

Part A Introduction				
Program: PG Diploma		**Class : M.Sc.**	**Year: I (IISEM.)**	**Session: 2025-26**
Subject: ELECTRONICS				
1	**Course Code**	**CC22**		
2	**Course Title**	**Data Communication and Networking (Paper-II)**		
3	**Course Type (Core Course/ Discipline Specific Elective/)**	**Core Course**		
4	**Pre-requisite (if any)**	**To study this course a student must have a Bachelor's degree with Electronics/ Physics as major or minor subject.**		
5	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** **1. Demonstrate the basics of modulation and its development in India.** **2. Understand the concept of multiplexing used in data communication.** **3. Illustrate different types of transmission media, error control, codes used in data communication.** **4. Define network terminology, topology.** **5. Explain OSI model with its different layers.**		
6	**Credit Value**	**6**		
7	**Total Marks**	Max. Marks: 40+60=100	Min. Passing Marks:16+24=40	

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week): 6 Lectures (in hours per week)

Unit	Topics	No. of Lectures (1 Hour Each)
I	Role of Prof. U R Rao, Former Chairman of ISRO, in development of India's first satellite "Aryabhata", Contribution of Scientist Vijay Pandurang Bhatkar in development of India's PARAM supercomputer. Modulation, need for modulation, Continuous wave, Pulse modulation: Digital and Analog, Code modulation, PCM codes, Delta Modulation PCM, Adaptive Delta modulation, Differential Pulse Code Modulation, CODEC's, Frame synchronization, bit interleaving versus word interleaving. **Activities:** 1. Prepare a comparison chart of various modulation techniques. 2. Organize a debate on topics related to contribution of India in information and telecommunication.	**18**
II	Multiplexing, concept of multiplexing, types of multiplexing: FDM, WDM, TDM, Frequency Division multiplexing, AT&TSFDM Hierarchy, composite baseband signal: formation of group, formation of super-group, formation of master-group.	**18**

	Activities: 1. Provide a list of items: coaxial cable, fiber optic, Bluetooth, Wi-Fi etc ask Students to categorize them as: wire/ wired. 2. Peer Teaching: students will select topics from all units and take a class for peer group.	
III	Data Communication: Data Communication Circuits, Data Communication Codes, Error Control, synchronization, data communication hardware, serial interface, transmission media and data modems, data communication protocols, public data network, ISO Protocol Hierarchy, Local Area Network. **Activities:** 1. Error detection: Give a binary message and ask students to check or add parity bits (even or odd) using parity bit or checksum method. Then simulate an error and ask if it's detected. 2. List different protocols and their applications/ functions and ask students to match them.	**18**
IV	Network, Types- Client, Server, introduction to various types of servers, client/server architecture. Classification of Networks: LAN, MAN, WAN Network Topology: Bus, Star, Ring, Star bus, Star ring, Mesh – Features, Advantages and disadvantages. Transmission Modes: simplex, half duplex and full duplex, Asynchronous & synchronous Transmission, Parallel and Serial Transmission. **Activities:** 1. Prepare a chart showing different types of topologies. 2. Ask students to prepare a role play showing different transmission modes.	**18**
V	THE OSI MODEL: Layered Architecture, Encapsulation 4.2 Layers in OSI Model (Functions of each layer)-Physical Layer, Data-Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer 4.3 TCP/IP Layers and their functions. **Activities:** 1. Visit to an Electronic industry/ Research Laboratory (if possible). 2. Prepare presentation on different topics related to Data communication.	**18**
Keywords/Tags: Modulation, Multiplexing, Data Communication, Network, OSI Model.		
Part C-Learning Resources		
Text Books, Reference Books, Other resources		

Suggested Readings:

1. UR Rao: The story of an ordinary man who did extraordinary things, South First.
2. The Little-Known Story of How India's First Indigenous Supercomputer Amazed the World in 1991, The better India.
3. The Life and times of U R Rao, Prashanth G N, Nakutanti Prakashana.
4. Data Communications and Networking: Fourauzan B., Tata McGraw-Hill Publications.
5. Electronic Communication System: Wayne Tomasi, Prentice Hall, New Jersey.
6. Computer Networks: Tanenbaum A., PHI.
7. Data Communication and Computer Network, Dr. Sanjay Sharma, S. K. Kataria & Sons.
8. Data Communications and Computer Networks, Brijendra Singh, Prentice-Hall of India Pvt.Ltd.

Suggested equivalent online courses:

https://www.coursera.org/learn/data-communication-networks
https://nptel.ac.in/courses/106105082
https://www.udemy.com/course/masterclass-data-communication-and-computer-networking
https://onlinecourses.nptel.ac.in/noc22_ee61/preview

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks : 100

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Any remarks/ suggestions:

Part A Introduction				
Program: PG Diploma	**Class: M.Sc.**	**Year: I (II Sem.)**	**Session: 2025-26**	
Subject: Electronics				
1	**Course Code**	**PC21**		
2	**Course Title**	**Operational Amplifier (Lab-I)**		
3	**Course Type (Core Course/ Discipline Specific Elective/)**	**Practical Course**		
4	**Pre-requisite (if any)**	**-**		
5	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** **1. Recognize the components and related experiment and accessories like CRO, signal generator required to perform the experiment.** **2. Perform experiments for understanding the working of operational Amplifier.** **3. Implement different applications of Op-Amp.** **4. Use CRO for comparing and measuring of signals.** **5. Prepare Laboratory Record of all the experiments performed.**		
6	**Credit Value**	**4**		
7	**Total Marks**	Max. Marks: 40+60=100	Min. Passing Marks:16+24=40	

Part B- Content of the Course	
Total No. of Lectures-Tutorials-Practical (in hours per week): 2 hours per credit per week **L-T-P: 120 Hrs**	
Lab Experiments **1. Study of Op-Amp characteristic.** **2. Study of Op-Amp as Adder and Subtractor.** **3. Study of Op-Amp as Integrator.** **4. Study of Op-Amp as Differentiator.** **5. Study of Op-Amp as Inverting Amplifier.** **6. Study of Op-Amp as Non-inverting Amplifier.** **7. Study of Op-Amp as Schmitt trigger.** **8. Study of Op-Amp as Zero Crossing Detector.**	**120 Hrs**

9. Study of Op-Amp as Adder and Subtractor. 10. Study of Op-Amp as sine to square wave converter	

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. **Practical Data Communications, Roger L. Freeman, Wiley.**
2. **Data Communications and Networking, Behrouz A. Forouzan, McGraw-Hill Companies.**
3. **Data Communication and Computer Networks, Dr. Sanjay Sharma, M/s. S.K. Kataria & Sons.**

Suggested equivalent online courses:

http://www.nitttrkol.ac.in/vlab-cse-nl-exp-1.php#top
https://kcgcollege.ac.in/Virtual-Lab/Electronics-and-Communication-Engineering/simulation.html
https://vlab.amrita.edu/index.php?sub=59&brch=163&sim=260&cnt=2644

Part D-Assessment and Evaluation

Suggested continuous Evaluation Methods:

Internal Assessment (A):	**40 Marks**
Lab Record/ Class Interaction/ Quiz	**15**
Attendance in the Lab.	**10**
Assignments (Technology Dissemination (e.g. training of common online citizen services or software tools to elderly persons/ Industrial Training (10 hours)/ mini project (including coding + project + demo + report))	**15**
External Assessment	**60 Marks**
Viva Voce Practical	**30**
Experiments	**30**
Total Marks (A+B)	**100 Marks**
Any remarks/ suggestions:	

<table>
<tr><th colspan="5">Part A Introduction</th></tr>
<tr><td colspan="2">Program: PG Diploma</td><td>Class: M.Sc.</td><td>Year: I (II Sem.)</td><td>Session: 2025-26</td></tr>
<tr><td colspan="5">Subject: Electronics</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="3">PC22</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Data Communication (Lab-II)</td></tr>
<tr><td>3</td><td>Course Type (Core Course/ Discipline Specific Elective/)</td><td colspan="3">Practical Course</td></tr>
<tr><td>4</td><td>Pre-requisite (if any)</td><td colspan="3">-</td></tr>
<tr><td>5</td><td>Course Learning outcomes (CLO)</td><td colspan="3">On successful completion of this course, the students will be able to:
1. Recognize the components and related experiment and accessories like CRO, signal generator required to perform the experiment.
2. Perform experiments for understanding the concepts of modulation and demodulation.
3. Understand the basics of digital modulation techniques.
4. Convert analog data to digital and vice versa.
5. Prepare Laboratory Record of all the experiments performed.</td></tr>
<tr><td>6</td><td>Credit Value</td><td colspan="3">4</td></tr>
<tr><td>7</td><td>Total Marks</td><td>Max. Marks: 40+60=100</td><td colspan="2">Min. Passing Marks:16+24=40</td></tr>
<tr><th colspan="5">Part B- Content of the Course</th></tr>
<tr><td colspan="5">Total No. of Lectures-Tutorials-Practical (in hours per week): 2 hours per credit per week
L-T-P: 120 Hrs</td></tr>
<tr><td colspan="4">Lab Experiments

1. To Study Amplitude Modulation.

2. To Study Frequency modulation.

3. To Study Delta Modulation.

4. To Study Differential pulse code modulation (DPCM).

5. To Study Quadrature amplitude modulation (QAM).

6. To Study Pulse code modulation (PCM).

7. To Study Frequency Shift Keying (FSK).

8. To Study A/D (Analog to Digital) Converter.</td><td>120 Hrs</td></tr>
</table>

9. To Study D/A (Digital to Analog) Converter.	

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

4. **Practical Data Communications, Roger L. Freeman, Wiley.**
5. **Data Communications and Networking, Behrouz A. Forouzan, McGraw-Hill Companies.**
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Part D-Assessment and Evaluation

Suggested continuous Evaluation Methods:

Internal Assessment (A):	**40 Marks**
Lab Record/ Class Interaction/ Quiz	**15**
Attendance in the Lab.	**10**
Assignments (Technology Dissemination (e.g. training of common online citizen services or software tools to elderly persons/ Industrial Training (10 hours)/ mini project (including coding + project + demo + report))	**15**
External Assessment	**60 Marks**
Viva Voce Practical	**30**
Experiments	**30**
Total Marks (A+B)	**100 Marks**
Any remarks/ suggestions:	