Government Science College, Jabalpur

Syllabus (I,II,III) Year
2022-23

Electronics

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B.Sc. I Year

Format for Syllabus of Theory Paper

Part A Introduction				
Program: Certificate/Diploma Degree/		**Class`: BSc**	**Year: I**	**Session: 2021-22**
Subject: ELECTRONICS				
1	**Course Code**	**S1-ELECT**		
2	**Course Title**	**Semiconductor Devices (paper 1)**		
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	**Core**		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject **Science** in class/12th ..... **This course can be opted as an elective by the students of following subjects: NA**		
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to:** CLO1: Describe the behavior of semiconductor materials CLO2: Reproduce the I-V characteristics of diode/BJT/MOSFET devices CLO3: Apply standard device models to explain/calculate critical internal parameters of semiconductor devices CLO4: Explain the behavior and characteristics of power devices such as SCR/UJT etc.		
	Credit Value	**4**		
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks:33	

Part B- Content of the Course		
Total No. of Lectures-Tutorials-Practical (in hours per week): 60 **L-T-P: 2-0-0**		
Unit	**Topics**	**No. of Lectures**
1	**Semiconductor Basics:** Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices, Energy Band in Solids, Concept of Effective Mass, Density of States, Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Derivation of Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations. Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation And Recombination Processes, Continuity Equation.	**14**
2	**P-N Junction Diode**: Formation of Depletion Layer, Space Charge at a Junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance of an Abrupt Junction. Concept of Linearly Graded Junction, Derivation of Diode Equation and I-V Characteristics. Zener and Avalanche Junction Breakdown Mechanism. Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics, applications	**14**

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3	**Bipolar Junction Transistors (BJT):** PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain, Energy Band Diagram of Transistor in Thermal Equilibrium, Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents), Base-Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations. Metal Semiconductor Junctions: Ohmic and Rectifying Contacts.	**14**
4	**Field Effect Transistors:** JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage Output Characteristics. MOSFET, types of MOSFETs, Circuit symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel and P Channel) and Enhancement type MOSFET (both N channel and P channel). Complimentary MOS (CMOS). **Power Devices:** UJT: Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression. SCR: Construction, Working and Characteristics, Triac, Diac, IGBT, MESFET, Circuit symbols, Basic constructional features, Operation and Applications.	**18**

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

1.Suggested Readings:

1. Malvino A. P., *Electronic Principles,* Tata Mc Graw Hill Pub, 7th Ed, 2017
2. Mehta V. K., Principles of Electronics, S. Chand & Co, 2007
3. S. M. Sze, Physics of Semiconductor Devices: Physics and Technology, 2ndEdition, Wiley India edition , 2008.

2. Suggestive digital platforms web links

National Digital Library: **https://ndl.iitkgp.ac.in/**

Suggested equivalent online courses:

1.https://www.coursera.org/

2. **Lectures:** MITopencourseware, MIT Course Number 6.012
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/

2.NPTEL E-Learning Courses: https://nptel.ac.in/courses/117/102/117102061/

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks : 100

Continuous Comprehensive Evaluation (CCE) : 25marks University Exam (UE) 75 marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE):25	Class Test Assignment/Presentation	15 10
External Assessmen : University Exam Section: 75 Time : 02.00 Hours	**Section(A)** : Three Very Short Questions (50 Words Each) **Section (B) :** Four Short Questions (200 Words Each) **Section (C) :** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total 75

Any remarks/ suggestions:

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Format for Syllabus of Practical Paper

Part A Introduction			
Program: Certificate/Diploma Degree/	**Class`: BSc**	**Year: I**	**Session:2021-22**

Subject: ELECTRONICS			
1	**Course Code**	**S1-ELEC1P**	
2	**Course Title**	Semiconductor Devices Laboratory **(paper1)**	
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	**Core**	
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject **Science** in class 12th **and have opted S1-ELEC2G. This course can be opted as an elective by the students of following subjects: NA**	
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to:** CLO1: Examine the characteristics of basic semiconductor devices CLO2: Perform experiments for studying the behavior of semiconductor devices for circuit design applications CLO3: Calculate various device parameters' values from their IV characteristics CLO4: Interpret the experimental data for better understanding the device behavior	
6	**Credit Value**	**2**	
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks:33

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week):60
L-T-P: 0-0-2

Unit	Topics	No. of Lectures
1	1. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode. 2. Study of the I-V Characteristics of the CE configuration of BJT and obtain r_i, r_o, β. 3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o, α. 4. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltage gain, r_i, r_o.	60

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	5. Study of the I-V Characteristics of the UJT. 6. Study of the I-V Characteristics of the SCR. 7. Study of the I-V Characteristics of JFET. 8. Study of the I-V Characteristics of MOSFET. 9. Study of Characteristics of Solar Cell 10. Study of Hall Effect.	

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co, 2008
2. Harnam Singh, P. S. Hemne, Practical Physics, S Chand & Co, 2000

Suggestive digital platforms web links

National Digital Library: **https://ndl.iitkgp.ac.in/**

Suggested equivalent online courses:

Virtual Lab: http://vlabs.iitkgp.ac.in/be/

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	10	Table work / Experiments	50
TOTAL	25		75

Any remarks/ suggestions:

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Format for Syllabus of Theory Paper

Part A Introduction				
Program: Certificate/Diploma Degree/		**Class`: BSc**	**Year: I**	**Session: 2021-22**
Subject: ELECTRONICS				
1	**Course Code**	**S1-ELEC2T**		
2	**Course Title**	Basic Circuit Theory and Network Analysis **(paper2)**		
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	**Core**		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject **Science** in class/12th ..... **This course can be opted as an elective by the students of following subjects: NA**		
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to:** CLO1: Study circuits in a systematic manner suitable for analysis and design. CLO2: Understands how to formulate circuit analysis problems in a mathematically tractable way with an emphasis on solving linear systems of equations. CLO3: Analyze the electric circuit using network theorems. CLO4: Determine Sinusoidal steady state response. CLO5: Understand the two–port network parameters with an ability to find out two-port network parameters & overall response for interconnection of two-port networks		
6	**Credit Value**	**4**		
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks:33	

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week): 60
L-T-P: 2-0-0

Unit	Topics	No. of Lectures
1	**Basic Circuit Concepts**: Voltage and Current Sources, Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel. Inductors: Fixed and Variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Inductance in series and parallel, Testing of resistance and inductance using multimeter. Capacitors: Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing	13

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	the value of capacitors, testing of capacitors using multimeter.	
2	**Circuit Analysis:** Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta Conversion. **DC Transient Analysis:** RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits With Sources, DC Response of Series RLC Circuits.	13
3	**AC Circuit Analysis:** Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor, Complex Impedance, Power in AC Circuits: Instantaneous Power, Average Power, Reactive Power, Power Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits. Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth. Passive Filters: Low Pass, High Pass, Band Pass and Band Stop.	18
4	**Network Theorems**: Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem. AC circuit analysis using Network theorems. Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.	16

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

1.Suggested Readings:

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill, 2004
2. M. Nahvi and J. Edminister, Electrical Circuits, , Schaum's Outline Series, Tata McGraw Hill, 2005
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education, 2004

Other Resources:

1. Doug Lowe, Electronics All-in-One for Dummies, Wiley, 2nd Ed, 2017

2. Suggestive digital platforms web links

National Digital Library: **https://ndl.iitkgp.ac.in/**

Lectures: https://ocw.mit.edu/index.htm,

Videos: https://www.youtube.com/c/mitocw/search?query=circuit%20theory

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 25 marks University Exam (UE) 75 marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE):25	Class Test Assignment/Presentation	15 10
External Assessment: University Exam Section: 75 Time : 02.00 Hours	**Section(A)**: Three Very Short Questions (50 Words Each) **Section (B) :** Four Short Questions (200 Words Each) **Section (C) :** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total 75

Any remarks/ suggestions:

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Format for Syllabus of Practical Paper

Part A Introduction				
Program: Certificate/Diploma Degree/		**Class: BSc**	**Year: I**	**Session: 2021-22**
Subject: ELECTRONICS				
1	**Course Code**	**S1-ELEC2P**		
2	**Course Title**	Basic Circuit Theory and Network Analysis Lab **(paper2)**		
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	**Core**		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject **Science** in class 12th ..... **This course can be opted as an elective by the students of following subjects: NA**		
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to:** CLO1: Verify the network theorems and operation of typical electrical and electronic circuits. CLO2: Choose the appropriate equipment for measuring electrical quantities and verify the same for different circuits. CLO3: Prepare the technical report on the experiments carried		
6	**Credit Value**	**2**		
7	**Total Marks**	Max. Marks: 25+75	Min. Passing Marks:33	

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week):60
L-T-P: 0-0-2

Unit	Topics	No. of Lectures
1	1. Familiarization with a) Resistance in series, parallel and series – Parallel. b) Capacitors & Inductors in series & Parallel. c) Multimeter – Checking of components. d) Voltage sources in series, parallel and series – Parallel e) Voltage and Current dividers	**10**
2	Measurement of Amplitude, Frequency & Phase difference using CRO	**4**
3	Verification of Kirchoff's Law	**4**
4	Verification of Norton's theorem	**4**

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5	Verification of Thevenin's Theorem.	4
6	Verification of Superposition Theorem	4
7	Verification of the Maximum Power Transfer Theorem	4
8	RC Circuits: Time Constant, Differentiator, Integrator	4
9	Designing of a Low Pass RC Filter and study of its Frequency Response	4
10	Designing of a High Pass RC Filter and study of its Frequency Response	4
11	Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width	14

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. D C. Tayal, Basic Circuit theory and Network Analysis, Himalayan Publishing House, 2018
2. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co, 2008
3. Harnam Singh, P. S. Hemne, Practical Physics, S Chand & Co, 2000.

Suggestive digital platforms web links
National Digital Library: **https://ndl.iitkgp.ac.in/**

Suggested equivalent online courses:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php
2. https://vlab.amrita.edu/index.php?sub=1&brch=75

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	10	Table work / Experiments	50
TOTAL	25		75

Any remarks/ suggestions:

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B.Sc. II Year

PART A: Introduction			
Program: Diploma	Class: B.Sc.	Year: **Second**	Session: **2022-23**
Subject: **Electronics**			

1.	Course Code	**S2-ELEC1T**	
2.	Course Title	**Electronics Circuits**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core Course**	
4.	Pre-Requisite (if any)	**Nil**	
5.	Course Learning Outcomes(CLO)	After completing this course student will be able to: • Illustrate about rectifiers, transistor and FET amplifiers and its biasing. Also compare the performances of its low frequency models. • Describe the frequency response of MOSFET and BJT amplifiers. • Explain the concepts of feedback and construct feedback amplifiers and oscillators. • Summarizes the performance parameters of amplifiers with and without feedback	
6.	Credit Value	**4 credits**	
7.	Total Marks	Max.Marks: **30+70**	**Min. Passing Marks: 33**

PART B: Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**

Total No. of Lectures: **60**

Unit	Topics	No. of Lectures
I	**Diode Circuits**: Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point. Clipping and clamping circuits. Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Filters: types, circuit diagram and explanation of shunt capacitor filter with waveforms. Zener diode regulator circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.	14
II	**Bipolar Junction Transistor:** Review of CE, CB Characteristics and regions of operation. Hybrid parameters. Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor, Fixed bias without and with RE, collector to base bias, voltage divider bias and emitter bias (+VCC and –VEE bias), circuit diagrams and their working. Transistor as a switch, circuit and working, Darlington pair and its applications. BJT amplifier (CE), dc and ac load line analysis, hybrid model of CE configuration,	15

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	Quantitative study of the frequency response of a CE amplifier, Effect on gain and bandwidth for Cascaded CE amplifiers (RC coupled).	
III	**Feedback Amplifiers:** Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, gain, input and output impedances . Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator and Hartley oscillator.	13
IV	**MOSFET Circuits:** Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits. **Power Amplifiers:** Difference between voltage and power amplifier, classification of power amplifiers, Class A, Class B, Class C and their comparisons. Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. Circuit operation of complementary symmetry Class B push pull power amplifier, crossover distortion, heat sinks. **Single tuned amplifiers:** Circuit diagram, Working and Frequency Response for each, Limitations of single tuned amplifier, Applications of tuned amplifiers in communication circuits.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronic devices, David A Bell, Reston Publishing Company
3. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGrawHill (2002)

Reference Book:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
2. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
3. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
4. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw

Suggestive digital platform web links

MITopencourseware, MIT Course No. 6.012,https://ocw.mit.edu/courses/electrical- engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-spring- 2009/lecture-notes/

Suggested equivalent online courses

https://swayam.gov.in/nd1_noc19_ee38/preview

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PART D: Assessment and Evaluation				
Internal Assessment: Continuous Comprehensive Evaluation (CCE): **30 Marks** Shall be based on allotted assignments and Class Tests. The marks shall be as follows:			**External Evaluation:** University Exam (UE): **70 Marks** **Time: 2 hours**	
A. Submission of Assignment followed by Presentation		**10 Marks**	**Section (A):** Three Very Short Questions (50 Words Each) **OR** 09 MCQ Questions	03 x 03 = **OR** 09 x 01 = **09 Marks**
B. Class Test (Descriptive + objective)	Best two test Marks **20 Marks**	Best two test Marks **20 Marks**		
Class Test I	10 Marks		**Section (B):** Four Short Questions (200 Words Each)	04 x 09 = **36 Marks**
Class Test II	10 Marks		**Section (C):** Two Long Questions (500 Words Each)	02 x 12.5 = **25 Marks**
Class Test III	10 Marks			
Total Internal Assessment Marks (A+B)		**30 Marks**	**Total External Evaluation Marks(A+B+C)**	**70 Marks**

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PART A: Introduction			
Program: DIPLOMA Class: **B.Sc.**		Year: **Second**	Session: **2022-23**
Subject: : **Electronics**			
1.	Course Code	**S2-ELEC1P**	
2.	Course Title	**Electronics Circuits Laboratory**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core Course**	
4.	Pre-Requisite (if any)	**Open for all**	
5.	Course Learning Outcomes (CLO)	After completing this course student will learn • Understand and analyze electronic circuits. • Choose the appropriate equipment for measuring electrical quantities and verify the same for different circuits. • Ability to understand and apply circuit theorems and concepts in engineering applications • Prepare the technical report on the experiments carried.	
6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **30+70**	**Min. Passing Marks:** 33

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P (0-0-2)	
Total No. of Lab hours: 60 Hrs. (2 hours per week)	
Lab Assignments 1. Study of the half wave rectifier and Full wave rectifier. 2. Study of power supply using C filter and Zener diode. 3. Designing and testing of 5V/9 V DC regulated power supply and find its load-regulation 4. Study of clipping and clamping circuits. 5. Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration fortransistors. 6. Designing of a Single Stage CE amplifier. 7. Study of Class A, B and C Power Amplifier. 8. Study of the Colpitt's Oscillator.	**No. of Lab (Hours)**

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9. Study of the Hartley's Oscillator. 10. Study of the Phase Shift Oscillator 11. Study of the frequency response of Common Source FET amplifier.	
	60

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronic devices, David A Bell, Reston Publishing Company

Suggestive digital platform web links

- https://swayam.gov.in/nd1_noc19_ee38/preview
- *http://vlabs.iitkgp.ernet.in/dec/*

PART D: Assessment and Evaluation

Internal Assessment (A):	**30 marks**
Lab Record/Class interaction/quiz	10
Attendance in the Lab	05
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 Evaluation (B) :	**70 marks**
Viva Voce on Practical	10
Practical Record File	10
Experiments	50 marks
Total Marks (A+B)	**100** marks

Any remarks/suggestions: Students should also prepare a small Audio-video clip to present the details of

- Assignments submitted
- Imparting training of common online citizen services or software tools
- Mini Project or Industrial Training

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PART A: Introduction			
Program: DIPLOMA	Class: **B.Sc.**	Year: **Second**	Session: **2022-23**
Subject: **Electronics**			

1.	Course Code	**S2-ELEC2T**	
2.	Course Title	**Operational Amplifiers and Applications**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core Course**	
4.	Pre-Requisite (if any)	**Nil**	
5.	Course Learning Outcomes(CLO)	After completing this course student will be able to: • Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques. • Elucidate and design the linear and non linear applications of an op-amp and special application ICs. • Explain and compare the working of multi vibrators using special application IC 555 and general purpose op-amp.	
6.	Credit Value	**4 credits**	
7.	Total Marks	Max.Marks: **30+70**	**Min. Passing Marks: 33**

PART B: Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**

Total No. of Lectures: **60**

Unit	Topics	No. of Lectures
I	**Basic Operational Amplifier:** Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741) **Op-Amp parameters**: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.	18
II	**Op-Amp Circuits:** Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter. Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.	18

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	Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator, and Voltage controlled oscillator.	
III	**Multivibrators (IC 555):** Block diagram, Astable and monostable multivibrator circuit, Applications of Monostable and Astable multivibrators. Phase locked loops (PLL): Blockdiagram, phase detectors, IC565. **Fixed and variable IC regulators:** IC 78xx and IC 79xx -concepts only, IC LM317- output voltage equation	12
IV	**Signal Conditioning circuits:** Sample and hold systems, Active filters: First order low passand high pass butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Log and antilog amplifiers.	12

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks:

1. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
2. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education (2001)
3. J. Millman and C.C. Halkias, Integrated Electronics, Tata McGraw-Hill,(2001)

Reference Book:

Suggestive digital platform web links

https://onlinecourses.nptel.ac.in/noc19_ee39/preview

Suggested equivalent online courses

https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2

PART D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **30 Marks** Shall be based on allotted assignments and Class Tests. The marks shall be as follows:			**External Evaluation:** University Exam (UE): **70 Marks** **Time: 2 hours**	
C. Submission of Assignment followed by Presentation		**10 Marks**	**Section (A):** Three Very Short Questions (50 Words Each) **OR** 09 MCQ Questions	03 x 03 = **OR** 09 x 01 = **09 Marks**
D. Class Test (Descriptive + objective)	Best two test Marks **20 Marks**	Best two test Marks **20 Marks**		
Class Test I	10 Marks		**Section (B):** Four Short Questions (200 Words Each)	04 x 09 = **36 Marks**
Class Test II	10 Marks		**Section (C):** Two Long Questions (500 Words Each)	02 x 12.5 = **25 Marks**
Class Test III	10 Marks			
Total Internal Assessment Marks (A+B)		**30 Marks**	**Total External Evaluation Marks(A+B+C)**	**70 Marks**

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21.2.2022

DIPLOMA PART A: Introduction			
Program:	Class: **B.Sc.**	Year: **Second**	Session: **2022-23**
Subject: : Electronics			

1.	Course Code	**S2-ELEC2P**	
2.	Course Title	**Operational Amplifiers and Application Lab**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core Course**	
4.	Pre-Requisite (if any)	**Open for all**	
5.	Course Learning Outcomes (CLO)	After completing this course student will learn to • Interpret op-amp data sheets. • Analyze and prepare the technical report on the experiments carried out. • Design application oriented circuits using Op-amp and 555 timer ICs. • Create and demonstrate live project using ICs. • Prepare the technical report on the experiments carried.	
1.	Credit Value	**2 Credits**	
2.	Total Marks	Max. Marks: **30+70**	**Min. Passing Marks:** 33

PART B: Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P (0-0-2)

Total No. of Lab hours: 60 Hrs. (2 hours per week)

Lab Assignments	**No. of Lab (Hours)**
1. Study of op-amp characteristics: CMRR and Slew rate. 2. Designing of an amplifier of given gain for an inverting and non-inverting configurationusing an opamp. 3. Designing of analog adder and subtractor circuit. 4. Designing of an integrator using op-amp for a given specification and study its frequencyresponse. 5. Designing of a differentiator using op-amp for a given specification and study its frequencyresponse. 6. Designing of a First Order Low-pass filter using op-amp. 7. Designing of a First Order High-pass filter using op-amp. 8. Designing of a RC Phase Shift Oscillator using op-amp. 9. Study of IC 555 as an astable multivibrator.	

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10. Study of IC 555 as monostable multivibrator. 11. Designing of Fixed voltage power supply using IC regulators using 78 series and 79 series.	
	60

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)

Suggestive digital platform web links

https://vlab.amrita.edu/?sub=3&brch=60&sim=1119&cnt=2

PART D: Assessment and Evaluation

Internal Assessment (A):	**30 marks**
Lab Record/Class interaction/quiz	10
Attendance in the Lab	05
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 Evaluation (B) :	**70 marks**
Viva Voce on Practical	10
Practical Record File	10
Experiments	50 marks
Total Marks (A+B)	**100** marks

Any remarks/suggestions: Students should also prepare a small Audio-video clip to present the details of

- Assignments submitted
- Imparting training of common online citizen services or software tools
- Mini Project or Industrial Training

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