Shri Acharyaratna Deshbhooshan Shikshan Prasarak Mandal, Kolhapur

Mahavir Mahavidyalaya, Kolhapur (Autonomous)

Affiliated to Shivaji University, Kolhapur

Syllabus for Choice Based Credit System (NEP 2020)
Bachelor of Science (B. Sc.) Programme

Part	III	Course	Physics

Under the Faculty of Science & Technology

(To be introduced from Academic Year 2025 – 26 onwards)

Subject to the revisions & modifications made from time to time

Mahavir Mahavidyalaya, Kolhapur (Autonomous)
Affiliated to Shivaji University, Kolhapur

(New syllabus under Autonomy to be introduced from June, 2025 onwards)

Primary Information:			
Programme	**Bachelor of Science (B. Sc.) CBCS**		
Part	**III**	Semester	**V**
Course	**Physics**	Course Code	**MN**
Paper No.	**IX**	Course Type	**Semester**
Total Marks	**50 Marks**	Implementation	**2025 – 26**
Total Credits	**02**	Contact Hours	**02 / Week**
Course Title	**Digital and Analog Circuits and Instrumentation- I**		

Course Objectives:	
i)	To understand basic & derived gates.
ii)	To understand amplifier, power supply and oscillator.

Course Syllabus
(CR = Credits / IH: Instructional Hours)

Modules	**CR**	**IH**
Module I :	01	15
Unit I - Digital Electronics I : Review of basic logic gates, Derived logic gates (NOR, NAND, XOR and XNOR gates), NAND and NOR gates as universal gates, De Morgan's theorems. **Unit I - Digital Electronics II :** R-S flip flop, J-K flip- flop, Half adder, Full adder, 4-bit parallel binary adder, Counter.		
Module II :	01	15
Unit III –Transistors Amplifier: Review of output characteristics of transistor in common emitter mode, Single stage transistor CE amplifier, D.C. and A.C. equivalent circuits, load line analysis- d.c. load line, a.c. load line and Q point.		

Unit IV – Sinusoidal Oscillator : Feedback in amplifiers and its types, theory of feedback oscillator, Barkhausen's criterion for sustained oscillations, Oscillatory circuit (tank circuit), essentials of transistor oscillator, sinusoidal oscillators- phase shift oscillator, Colpitt's oscillator, Crystal oscillator using transistors.		

Course Outcomes:
On completion of the course, students will be able to:
i) Explain basic & derived gates.
ii) Explain amplifier, power supply and oscillator.

Primary Information:			
Programme	**Bachelor of Science (B. Sc.) CBCS**		
Part	**III**	Semester	**VI**
Course	**Physics**	Course Code	**MN**
Paper No.	**X**	Course Type	**Semester**
Total Marks	**50 Marks**	Implementation	**2025 – 26**
Total Credits	**02**	Contact Hours	**02 / Week**
Course Title	**Digital and Analog Circuits and Instrumentation- II**		

Course Objectives:	
i)	To understand basic theory and applications of Cathode Ray Oscilloscope.
ii)	To understand working of operational Amplifier and Timer.

Course Syllabus
(CR = Credits / IH: Instructional Hours)

Modules	CR	IH
Module I : **Unit I –Operational Amplifier I :** Differential amplifier and its type, Op-Amp, Block diagram of an Op- Amp. Op-Amp parameters, Characteristics of an ideal and practical Op-Amp (IC 741). **Unit II –Operational Amplifier II :** Applications of Op-Amps: Inverting amplifier and Non-inverting amplifier, Adder, Subtractor, Differentiator, Integrator.	01	15
Module II : **Unit III - Timer IC:** Block diagram of IC555, IC 555 Pin configuration, Applications of IC 555 as astable and monostable multivibrator. **Unit IV – Cathode Ray Oscilloscope :** Introduction to CRO, Block diagram of CRO, Principle, Construction and working of CRT, Applications of CRO: measurement of A.C. and D. C. voltages, periodic time, frequency and phase difference, Lissajous figures.	01	15

Course Outcomes:
On completion of the course, students will be able to:
i) Explain basic theory and applications of Cathode Ray Oscilloscope.
ii) Explain working of operational Amplifier and Timer.

Practical Course

Course Objectives:
1. Able to perform experiments in Electronics devices.
2. Develop practical skill, instruments handling skills, observational skills and problem solving skills.
3. To understand building and testing of various oscillators using BJT.

SEMISTERS	CR
SEM V	02
Group I 1. To verify the truth tables of NAND, NOR, Ex-OR and Ex-NOR gates by using basic gates with IC-74series. 2. To verify the De-Morgan's theorems by using IC-74 series. 3. Study of Half and Full adder. 4. Simplification of digital circuit using Boolean laws (paper-work). **Group II** 1. To design a single stage CE amplifier of given gain using voltage divider bias. 2. To built and test Colpitt's oscillator using BJT. 3. To built and test phase shift oscillator using BJT. 4. To determine frequency of a crystal oscillator	
SEM VI	02
Group III 1. To study Op-amp as an inverting amplifier. 2. To study Op-amp as Schmitt trigger. 3. To design and test an astable multivibrator using IC-555 Timer. 4. To design and test monostable multivibrator using IC-555 Timer.	

Group IV 1. To determine A.C. and D.C. sensitivity of the C.R.O. and to measure unknown frequency. 2. Measurement of phase shift of RC network using CRO. 3. To study Lissajous figures by using CRO 4. Electronic component testing using C. R. O.	

Course Outcomes:
• On completion of this course students will be expected to:
1) Students will be able to take measurements and readings with practical skills.
2) Develop applications using electronic devices & Circuits.
3) Built and test various oscillators using BJT.

Reference Materials -

Books for Reference

1.	Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2.	Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc- Graw Hill.
3.	. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
4.	Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning.
5.	Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7thEd.,2011, Tata McGraw Hill.
6.	Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6thEdn., Oxford University Press.
7.	Fundamentals of Digital Circuits, A. Anand Kumar, 2ndEdition, 2009, PHI Learning Pvt. Ltd.
8.	OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.
9.	Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A.

	Miller, 1994, Mc- Graw Hill.
10.	Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
11.	Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
12.	A text book of Electronics, SantanuChattopadhay, New Central Book Agency, Kolkata.
13.	Basic Electronics, 2ndEdition , B. Basavaraj, H. N. Shivashankar, Vikas Publishing house Pvt. Ltd. New Delhi.
14.	Electronic principles, V. K. Mehta
15.	Basic Electronics, Bhargava and Gupta
Books for Practical	
1.	Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, AsiaPublishing House.
2.	Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers
3.	A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition,2011, KitabMahal, New Delhi.
4.	B.Sc. Practical Physics, C.L.Arora, S.Chand& Company Pvt.Ltd., New Delhi
5.	B.Sc. Practical Physics, Harman Singh,Hemane, 2012 Edition.

Suggested methods of Teaching:	
i)	Offline Traditional Board Teaching
ii)	Power Point Presentation
iii)	Online Teaching on platform of Zoom or Google Meet

Scheme of Course Evaluation		
1.	End Semester Examination (ESE)	40
2.	Continuous Internal Evaluation (CIE)	10
3.	**Total Marks**	**50**

Suggested techniques for Continuous Internal Evaluation (10 Marks)	
1.	Seminar
2.	Assignments
3.	Offline / online MCQ test
4.	Unit Test
5.	Symbolic Test

Question Paper Pattern (40 Marks) Theory Exam		
Q. No.	**Nature / Type of Question**	**Marks**
1.	Multiple Choice Questions (MCQ) 6 Questions	**6 Marks** (1 Marks for each question)
2.	Write the answers in short 5 Questions	**10 Marks** (2 Marks for each question)
3.	Write short notes Attempt any 3 out of 5 questions	**12 Marks** (4 Marks for each question)
4.	Write descriptive questions Attempt any 2 out of 4 questions	**12 Marks** (6 Marks for each question)
5.	**Total**	**40 Marks**

Practical Examination

(A) The practical examination will be conducted on one day for three hours per day per batch of the practical examination.

(B) Each candidate must produce a certificate from the Head of the Department in her/his college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the semester. Candidates must produce their journals at the time of practical examination.

Question Paper Pattern (50 Marks) **Semester wise Practical Exam**		
Semester	**Nature / Type of Question**	**Marks**
III	Group I : One experiment Group II : One experiment Certified Journal (05 marks) & Oral (05 marks)	**20** **20** **10**
	Total Marks (For Semester III)	**50**
IV	Group III : One experiment Group IV : One experiment Certified Journal (05 marks) & Oral (05 marks)	**20** **20** **10**
	Total Marks (For Semester IV)	**50**
Total Marks		**100**