Subject: Physics
Semester: Six
Course Name: Digital Electronics
Existing Base Syllabus: HS Physics, Chemistry and Mathematics
Course Level: PHY352
Syllabus showing each unit against class number and marks

Unit no.	Unit content	No. of classes	Marks/Credit
Theory			
Unit I: Integrated Circuits (qualitative treatment only)	Active & Passive Components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. The scale of integration: SSI, MSI, LSI, and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs.	3	Credit - 3
Unit II: Digital Circuits	Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal, and Hexadecimal numbers. AND, OR, and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates	10	
Unit III: Boolean Algebra	Unit III: (Lectures 10) De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. The idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.	10	
Unit IV: Arithmetic Circuits	Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor.	5	
Unit V: Timers: IC 555	Timers: IC 555 (Lectures 03) Block diagram and applications: Astable multivibrator and Monostable multivibrator.	3	
Unit VI: Sequential Circuits	(Lectures 04) SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.	4	

Unit VII: Shift Registers	Serial-in-Serial-out. Serial-in-Parallel-out. Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).	4	
Unit VIII: Computer Organization	Input/output Devices. Data storage (the idea of RAM and ROM). Computer memory. Memory organization & addressing.	6	
Laboratory			
	At least four from the following:		Credit 1
	1. To design a switch (NOT gate) using (i) a PNP transistor and (ii) an NPN transistor. 2. To verify and design AND, OR, NOT, and XOR gates using NAND gates. 3. To design a combinational logic system for a specified Truth Table. 4. To convert a Boolean expression into a logic circuit and design it using logic gate ICs. 5. To design a Half Adder and Full Adder 6. To design a 4-bit binary Adder. 7. To design Half Subtractor and Full Subtractor 8. To design Adder-Subtractor using Full Adder IC. 9. To design an astable multivibrator of given specifications using 555 Timer. 10. To design a monostable multivibrator of given specifications using 555 Timer. 11. To build a D flip-flop circuit using NAND gates. 12. To build a JK flip-flop circuit using NAND gates. 13. To build JK Master-slave flip-flop using flip-flop ICs. 14. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs. 15. To build SR flip-flop circuit using NAND gates		

Reading list

1. Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, 7th Ed., 2011, Tata McGraw
2. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Digital Electronics G. K. Kharate ,2010, Oxford University Press
5. Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, 2001, PHI Learning

6. Logic circuit design, Shimon P. Vingron, 2012, Springer.
7. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
8. Digital Electronics, S. K. Mandal, 2010, 1st edition, McGraw Hill
9. Electronics Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit, 17th Ed, 2023, New Age International Publisher

Graduate Attributes

i. Course Objective

- To introduce the students to the basics of digital electronics and applications with handson experience in implementing some hardware.
- To help students develop a digital logic and apply it to solve real-life problems
- To analyze, design and implement various combinational and sequential logic circuits
- To classify different semiconductor memories.

ii. Learning outcome

After successful completion of the course student will be able to develop, implement and analyze digital logic circuits and apply them to solve real-life problems and classify different semiconductor memories

Theory Credit: 04 (Three)

Practical Credit: 01 (One)

No. of Required Classes: 45

No. of Contact Classes: 45

No. of Non-Contact Classes:

Particulars of Course Designer (Name, Institution, email id):

1) Prof. Banty Tiru, Gauhati University, btiru@gauhati.ac.in
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