Programme	B. Sc. Electronics				
Course Code					
Course Title	ELECTRONIC FUNDAMENTALS				
Type of Course	**Minor**				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in science				
Course Summary	This course introduces some of the basic electronics devices like diode and different type of transistors and also basic applications using these devices.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Identify and differentiate basic electronic components.	U	C	Instructor-Demonstration
CO2	Understand fundamentals laws of electric circuits.	U	C	Instructor-created exams /
CO3	Differentiate voltage source and current source	Ap	C	Instructor-created exams / Quiz
CO4	Explain principle and behaviour of semiconductor devices.	U	P	Instructor-created exams / Quiz
CO5	To understand and use basics of testing and measuring instruments	Ap	P	Practical Work
CO6	Build simple electronic circuits	Ap	P	Practical work
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Electronic Components**	**10**	**15**
	1	Introduction to Electronics	1	
	2	Introduction Passive Components: Resistor, Capacitor, Inductor, Transformer, resistor colour coding.	3	
	3	Voltage, Current, Voltage source, Current source, Ohm's Law, Kirchhoff's laws	3	
	4	R, C, L series and parallel connections.	3	
II		**Semiconductor diode**	**10**	**15**
	5	Classification of solids- Conductor, Insulator and semiconductor	2	
	6	Intrinsic and extrinsic semiconductors. N type and P type semiconductors, Minority and majority carriers.	2	
	7	Basic principle of operation of PN junction diode, depletion layer, biased PN junction V-I characteristics of diode	3	
	8	PIV of diode, Knee voltage, static and dynamic resistance of Diode.		
	9	Basic principles of LED and Zener diode and its Applications	3	
III		**BJT and FET**	**13**	**20**
	10	BJT Pins, Structure of NPN and PNP transistor.	1	
	11	Biased transistor, active ,saturation and cut off modes	1	
	12	CE transistor configuration.	1	
	13	Current gain of transistor in CE configuration	1	
	14	CE transistor Characteristics,	2	
	15	Introduction to FET, Types of FET, Comparison between FET and BJT.	4	
IV		**Electronic circuits**	**12**	**20**
	16	Introduction to rectifier, Rectifier types.	3	
	17	Circuit diagram and working of Half wave rectifier.		
	18	DC output voltage, ripple factor and rectifier efficiency of half wave rectifier.(detailed analysis not required)		
	19	Full wave rectifier, Circuit diagram of centre tap and bridge rectifiers.	3	
	20	DC output voltage, ripple factor and rectifier efficiency of full wave rectifier. (detailed analysis not required), Capacitor filter		
	21	Block diagram of DC Power supply,	3	
	22	Circuit diagram of CE transistor amplifier and voltage gain of CE amplifier.(Detailed analysis not required)	2	
V		**Electronics Practical** **Hardware implementation or Simulation Lab**	**30**	
	1	1) Familiarisation of Passive and active components 2) Validating Ohm's law 3) Application of KVL and KCL 4) Series and parallel connection of resistors. 5) VI characteristics of diode.	30	

		6) Reverse characteristics of zener diode. 7) Half wave rectifier.		

Note: The syllabus has five modules.There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

Text books:

1.Electronic Devices and Circuit Theory by Robert L Boyleshad.
2.Principles of electronics- V.K Metha.

3. Basic electronics and linear circuits – N.N Bhargava, Kurukshetra and Gupta.

4. Electronics Engineering - B.L.Theraja
5. Textbook of Applied electronics – R.S Sedha.

Online resources

1. https://onlinecourses.swayam2.ac.in/nou23_ec06/preview (Swayam portal online course)

2. https://onlinecourses.nptel.ac.in/noc21_mm03/preview (Swayam portal online course)

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	-	-	1	1			1	
CO 2	2	3	-	-	-	-	1	1			1	
CO 3	-	-	1	-	-	-	1	1			1	
CO 4	-	-	2	3	-	-	1	1			1	
CO 5	-	1	-	-	-	-	1	1			1	

CO 6	-	-	-	3	-	-	1	1			1	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code					
Course Title	FUNDAMENTALS OF DIGITAL ELECTRONICS				
Type of Course	**Minor**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Nil				
Course Summary	This course covers different number systems, Boolean algebra theorems, combinational logic circuits, sequential logic circuits and overview of computer memories.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand different number systems and logic gates	U	C	Instructor-Demonstration
CO2	Understand and Analyse simple combinational logic circuits	An	C	Instructor-created exams /
CO3	Understand and Analyse simple sequential logic circuits	An	C	Instructor-created exams / Quiz
CO4	Understand different type of computer memories	U	C	Instructor-created exams / Quiz
CO5	Design and implement simple combinational logic circuits.	An	P	Practical Work
CO6	Design and implement simple sequential logic circuits	An	P	Practical work
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Number system and codes**	**10**	**15**
	1	Decimal, Binary, Hexadecimal number systems conversion of one code to another. Binary Coded Decimal,	1	
	2	Logic Gates : Truth Tables, OR, AND, NOT, XOR, XNOR, Universal (NOR and NAND) Gates.	3	
	3	Boolean Algebra Theorems.	3	
	4	DeMorgan's Theorems.	3	
II		**Combinational Logic Analysis and Design**	**10**	**17**
	5	Standard representation of logic functions (SOP and POS).	2	
	6	Minimization of SOP expression using Karnaugh map.	2	
	7	Adder (half and full) and half subtractor and basic binary Decoder.	3	
	8	Multiplexers and Demultiplexers	3	
III		**Sequential logic circuit**	**15**	**22**
	9	Operation of S –R Latch and Gated D Latch	1	
	10	Flip flop (FF), S-R FF,	1	
	11	J-K FF and D type FFs.	1	
	12	Introduction to Counters (synchronous and asynchronous)	1	
	13	Logic circuit of 2 bit asynchronous and 2 bit synchronous counter	3	
	14	Introduction to shift registers different types of shift registers.	2	
	15	Logic circuit of serial in serial out shift register	2	
	16	Logic circuit of Johnson counter	2	
	17	Logic circuit of Ring counter	2	
IV		**Memories**	**10**	**16**
	18	Introduction to memory.	2	
	19	General memory operations. Read and write operation in a single bit memory device.	2	
	20	Basic concepts of RAM.	1	
	20	Types of RAM.	2	
	21	Basic concepts of ROM	1	
	22	Types of ROM	2	
V		**Digital Electronics Practical** **Hardware Implementation or Simulation Lab**	**30**	
	1	1. Familiarization of logic gates using ICs (NOT, OR, AND, XOR, NAND, NOR). 2. Implement a Half Adder using logic gates 3. Implement a Half subtractor logic gates.	30	

			4. Implement D flip flop using logic gates or IC 5. 4 bit adder using ICs 6. Multiplexer using ICs or logic gates. 7. Johnson counter 8. Ring counter		

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia .

2. Donald P. Leach, Albert Paul Malvino, Digital Principles and Applications, Tata McGraw Hill.
3. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education Asia, (2007) 30
4. R.L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill
5. https://onlinecourses.nptel.ac.in/noc24_ee52/preview

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	-	-	-	-	1					
CO 2	1	1	-	-	-	-	1					
CO 3	1	1	1	-	-	1	1	1			1	
CO 4	2	1	2	-	-	1	2	1			1	
CO 5	2	1	2	-	-	1	2	1			1	

CO 6	2	1	2	-	-	1	2	1			1	

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code					
Course Title	ARDUINO CODING WITH EMBEDDED C				
Type of Course	**Minor**				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge in Science.				
Course Summary	This course covers introduction to microcontrollers, fundamentals arduino platform, fundamentals of Embedded C, arduino programming and interfacing of sensors and actuators to the arduino board.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand arduino platform	U	C	Instructor-Demonstration
CO2	Understand fundamentals of embedded C	U	C	Instructor-created exams /
CO3	Write codes for simple input and out functions using arduino	U	C	Instructor-created exams / Quiz
CO4	Understand and write codes to interface sensors to arduino.	Ap	P	Practical work
CO5	Understand and write codes to interface motors to arduino	Ap	P	Practical Work
CO6	Build simple projects using Arduino	Ap	P	Practical work

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	**Unit**	**Content**	**Hrs**	**Marks 70**
I		**Introduction to arduino platform**	**8**	**15**
	1	Introduction to microcontroller, Features of AVR microcontroller.	2	
	2	Arduino overview, Key features of Arduino and Arduino board types	2	
	3	Various components on Arduino Board, Pin configuration arduino uno	2	
	4	Installation of arduino IDE	2	
II		**Embedded C**	**18**	**20**
	5	Introduction to embedded C, Program structure.	1	
	6	Data types: Character, byte, integer and word.	2	
	7	Variables and constant	2	
	8	Operators: Arithmetic operators, Comparison operators, Boolean operators and Bitwise operators.	3	
	9	Control statements: If else statement and Switch case statement.	2	
	10	Loops: While loop, Do while loop, For loop and Nested loop	3	
	11	Function and function declaration.	3	
	12	Strings.	2	
III		**Writing Arduino programming**	**10**	**15**
	13	Learning about the standard library of Arduino	3	
	14	Acquiring the skills for writing arduino sketch. Working with examples	2	
	15	Interfacing switches with arduino and Reading analog voltage using arduino	2	
	14	Interfacing LED and buzzer with arduino	1	
	15	Pulse width modulation	2	
IV		**The basic sensors and actuators using Arduino**	**18**	**20**
	16	Definition of sensor, Types of sensors. Difference between Analog and Digital sensors	2	
	17	Concept of ADC and roll of pull up and pull down resistor when interfacing sensors with an Arduino Uno.	2	
	18	Interfacing light sensor, temperature sensor, ultrasonic distance meter and humidity sensors to arduino uno board.	3	
	19	Reading data from the sensors on to the serial monitor.	3	
	20	Introduction to actuators	2	
	21	Actuator types and Principle of actuators.	2	
	22	Interfacing DC motor and stepper motor to arduino board.	4	

V	**Electronics Practical**		**30**	
	1	To blink an LED using arduino uno	30	
	2	Using push button to control LED using arduino uno.		
	3	Interfacing light sensor to arduino board		
	4	Interfacing temperature sensor to arduino board.		
	5	Interfacing DC motor to arduino Board		
	6	Interfacing stepper motor to arduino board.		

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module Vis designed to equip students with practical skills. The 20marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

References

1. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and

Sushabhan Choudhury.

2. https ://www.arduino.cc/en/Tutorial/HomePage

3. Arduino Made Simple by Ashwin Pajankar

4. Getting started with Arduino by Massino Banzi.

4. Embedded C, Pont, Michael J

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	-	-	-	1	-	-	-	2	-
CO 2	-	3	2	-	-	-	2	-	-	-	2	-
CO 3	-	-	2	-	2	2	2	-	-	-	2	-
CO 4	-	2	3	-	2	2	2	2	-	-	2	-

CO 5	-	2	3	-	2	2	2	2	-	-	2	-
CO 6	-	2	3	-	2	2	2	2	-	-	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	B. Sc. Electronics				
Course Code					
Course Title	COMPUTER HARDWARE				
Type of Course	**MDC**				
Semester	I				
Academic Level	100- 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	1. Basic understanding of electronics and digital circuits 2. Fundamental computer and number system Concept				
Course Summary	This course covers the fundamental concepts of computer hardware, including number systems, logic gates, internal components, operating systems, and software. Through a combination of theory and practical classes, students will gain a comprehensive understanding of how computers work and how to interact with them effectively.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the role of operating systems in managing hardware resources and providing a user interface for interaction with the computer system.	Ap & U	C	Instructor-created exams / Quiz
CO2	To become familiar with different number systems such as binary, octal, decimal, hexadecimal, and understand their significance	An & U	C	Assignment / Seminar Presentation
CO3	To analyse methods for converting numbers from one system to another, such as from binary to hexadecimal or decimal to binary	Ap & U	P	Seminar Presentation / Group Tutorial Work
CO4	To apply the truth tables to represent the behaviour of logic gates	R & U	F	Instructor-created exams / Home Assignments
CO5	To gain a comprehensive understanding of what system software is including operating systems, device drivers, and utility software structures and algorithms to address complex computational	An & U	C	One Minute Reflection Writing assignments

	challenges.			
CO6	To become knowledgeable about internal computer components such as motherboards, central processing units (CPUs), memory (RAM), storage devices	Ap& An	P	Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark (50)
I		**Introduction to Computer Hardware**	**8**	**10**
	1	Characteristics, Functionalities and applications of Computer	2	
	2	Generations of Computer	1	
	3	Block diagram of computer	1	
	4	IO Subsystem of a Computer -Bus Structures	3	
	5	Data processing cycle of computers and classification of computer	1	
	Computer Fundamentals – B. Ram			
II		**Number systems**	**8**	**10**
	6	Number System: Decimal, Binary, Hexadecimal, Octal -Conversions	4	
	7	1's & 2's complement, Representation of Positive and Negative Numbers	2	
	8	Arithmetic operation on Binary numbers, Addition and Subtraction	1	
	9	ASCII code, conversion -ASCII to Decimal, Decimal to ASCII	1	
	Computer Fundamentals – B. Ram			
III		**Logic Gates**	**5**	**10**
	10	Logic Gates, AND, OR, NOT GATES and their Truth tables.	2	
	11	Universal Gates, Boolean Theorems, DeMorgan's Theorems	3	
	Electronics And Microprocessors: B.V. Santhosh Krishna			
IV		**CPU, Storage devices and Software**	**15**	**20**
	12	CPU- Control unit, Memory and ALU, types of storage unit	2	
	13	Types of memory (RAM, ROM, Cache), Memory hierarchy	2	
	14	Storage Devices: HDD, SSD, Flash drives and memory cards	3	
	15	Types of software-System software &Application Software	2	
	16	Operating systems and classifications, characteristic features of OS	2	
	17	Malwares- protecting software for computer systems against threats	2	
	18	Types of Computer languages, Editor, Compiler, Assembler, Interpreter.	1	
	19	Parts of Motherboard	1	
	Introduction To Computers: Peter Norton Computer Organization And Design : P. Pal Chauduri			
V		**Open Ended Module: Mastering Hashing for Efficient Data Handling**	**9**	
	1	**Case studies:** 1. Discuss evaluation of core processors 2. Multicore processors **Real-World Applications and Trade-offs:** i. Assembling of computer ii. Installation of OS (windows/Linux)	9	

		iii. Installation of MS Office iv. Hard disk partition **Assessment:** **Group Assignment:** Different types of Pentium Core processors		

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	3	1	-	2	2	3	-	-	-	1
CO 2	3	-	-	3	-	-	3	-	-	-	1	-
CO 3	-	3	-	-	2	-	1	-	-	1	-	-
CO 4	-	2	-	3	-	-	3	-	-	2	-	-
CO 5	-	1	-	-	-	-	-	1	-	-	-	-
CO 6	1	-	-	-	-	3	3	3	-	-	1	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam

- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√			√
CO 2	√	√		√
CO 3	√			√
CO 4				√
CO 5		√		√
CO 6			√	

Reference

Text Books:

1.	Computer Fundamentals	B. Ram – New Age International Publishers	
2.	"Computer Organization & Architecture"	Rashid Sheikh	
3.	Computer Organization	Hamacher, Vranesic and Zaky, McGraw Hill.	
4.	Digital Logic and Computer Design	Morris Mano, PHI	
5.	Computer Organization and Architecture	William Stallings, Pearson Education Asia.	
	Introduction To Computers:	Peter Norton	

Others: *(Web / Journals / Course Packets / Class Notes / etc.:*
https://www.youtube.com/watch?v=fJbRqwFDWoE
https://www.youtube.com/watch?v=pJQ-bm3SY7s
https://www.youtube.com/watch?v=G3_GXImETg8
https://www.youtube.com/watch?v=I0lDau83Cbc

Programme	B. Sc. Electronic Science
Course Code	
Course Title	CLEAN ENERGY SOLUTIONS
Type of Course	**MDC**
Semester	II

Academic Level	100 - 199				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours**
	3	3	-	-	45
Pre-requisites	1. Basic Knowledge of Physical Science and Electricity.				
Course Summary	This course serves as an introduction to the fundamental concepts of clean energy, emphasizing its role in sustainable development. Participants will explore a wide range of energy sources, with a particular focus on renewable technologies, and gain insights into the solar power generation, components of solar PV system and their functions.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand clean energy sources and articulates its significance in addressing climate change and environmental challenges.	U	C	Assignment / Seminar Presentation
CO2	To become familiar with conventional and non-conventional energy sources.	U	C	Assignment / Seminar Presentation
CO3	To demonstrate proficiency in assessing the economic feasibility of clean energy projects.	Ap	P	Assignment / Seminar Presentation
CO4	To examine the basics of solar energy, its applications, and methods for storage.	U	P	Seminar Presentation / Group Tutorial Work
CO5	To understand different solar PV systems, considering off-grid, on-grid, and hybrid configurations.	U	P	Instructor-created exams / Quiz
CO6	To understand the functions and importance of charge controllers and inverters in solar power systems.	U	P	Assignment / Seminar Presentation

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)

Module	Unit	Content	Hrs (36+12)	Marks (50)
I		**Introduction to Clean Energy**	**5**	**6**
	1	Definition of Power and energy, Distinguishing Power from Energy	2	
	2	The Crucial Role of Energy in Development	1	
	3	Defining Clean Energy. Importance of Clean Energy in Climate Change Mitigation	1	
	4	Global Clean Energy Initiatives and Sustainability Goals.	1	
II		**Energy Sources**	**11**	**14**
	5	Classification of Energy Sources – Conventional and Non-conventional	1	
	6	Conventional energy (Non- Renewable) sources - Hydro Electric, Thermal and Nuclear,	2	
	7	Advantages and disadvantages of Conventional energy sources	2	
	8	Non-Conventional Energy (Renewable) sources - Bio-mass, geo-thermal, solar, wind energy, ocean energy and wave energy,	2	
	9	Advantages and disadvantages of Non-Conventional Energy sources	2	
	10	Comparison of Conventional and Non-Conventional Energy sources	2	
	11	Commercial energy sources - fossil-fuels, coal, oil, natural gas, hydro electric power, and nuclear	2	
	12	Advantages and disadvantages of Commercial energy sources	1	
III		**Solar Power System**	**15**	**20**
	13	Solar Energy Overview and Importance, storage of solar energy, solar applications- solar pump, solar water heater, solar distillation, solar cooker, solar green houses.	4	
	14	Storage of Solar Energy, Solar Energy Conversion, Solar PV Systems, Basic Components: Solar Panel, Battery System, Power Converter.	4	
	15	Types of Solar PV systems - off-grid, On-grid and Hybrid.	4	
	16	Comparison of Solar PV systems, Initial cost and payback period	3	
IV		**Solar PV system components and selection parameters**	**5**	**10**
	17	Solar Cell Function, Solar Technologies, Solar Cell Parameters – Voltage, Power Ratings, Efficiency.	2	
	18	Energy Storage: Battery Function, Types, Parameters, Selection, Maintenance.	2	
	19	Charge Controller and Inverter (Basic Functions)	1	
		Open Ended Module : Solar PV system	**12**	

V	1	**Case studies:** 1. Discuss clean energy initiatives 2. Classification of Energy sources **Real-World Applications and Trade-offs:** 1. Identification of Solar components 2. Economic Analysis of installing solar PV system **Assessment:** **Group Assignment:** Types of Solar PV system		

Note: The course is divided into five modules, with four having total 19 fixed units and one open-ended module with a variable number of units. There are total 36 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 19 units from the fixed modules.

References

a) Renewable energy; power for a sustainable future; oxford; Stephen peake; oxford university press- 2017
b) Renewable energy systems; Devid M, Buchla, Thomas E kissell, Thomas, L Floyd; Pearson India Education Services Pvt. Ltd. 2017
c) Fundamentals of Renewable Energy Systems Paperback – D.Mukherjee, New Age International Publisher; First edition (2011)
d) Solar Power Hand Book, Dr. H. Naganagouda(2014)
e) Solar Photovoltaic; Chetansingh solanki; PHI, Learning private ltd., New dehli- 2018
f) Non-conventional Sources of Energy , G.D Rai, Khanna Publishers, Delhi, 2012
g) Solar Power Hand Book, Dr. H. Naganagouda (2014)
h) Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Signal K.C New Arrivals –PHI; 2 Edition (2011)
i) “Renewable energy power for a sustainable future” by Godfrey Boyle ,2004 Oxford University Press in association with the Open university.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	-	-	-	-						
CO 2	1		-	-	-	-						
CO 3	-	1	2	-	-	-						
CO 4	-	-	-	2	-	-						
CO 5	-	-	1	-	-	-						

CO 6	-	-	-	2	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		√		√
CO 2		√		√
CO 3	√			√
CO 4	√			√
CO 5	√			√
CO 6	√			√