Programme Template

1. Name of the Programme and Code	***Bachelor of Technology in Energy Engineering*** Undergraduate Programme **ES1**
2. Degree (UG/PG)	UG
3. Minimum Duration of the Programme (Specify for FT and PT, if applicable)	4 years, FT
4. Maximum Duration of the Programme (Specify for FT and PT, if applicable)	6 years, FT
5. Capacity (Max. Student Strength) of the Programme	40
6. Number of Regular Faculty Members Involved as Teaching Faculty in the Programme	19 regular faculty at DESE, IIT Delhi (As of May 31, 2025) + 5 faculty (on deputation / retiring this year)
7. Minimum Credit Requirements for the Degree	148

8. Articulate the Program Learning Outcomes (PLO): *Graduates of this program will be able to:*

Abbreviation	Description
ILO1	analyze, synthesize and communicate ideas.
ILO2	demonstrate scientific temperament, integrity, personal and professional responsibility, and respect for others.
ILO3	identify, analyze and solve challenging problems within and across disciplines
ILO4	apply their analytical skills to other areas of knowledge and design sustainable solutions to issues important in our society ethically.

Abbreviation	Description
PLO1	Apply ethical principles and knowledge of relevant regulatory framework so as to establish the interrelationships between energy, environment and sustainability.
PLO2	Evaluate the vital need and various potential routes for achieving energy transition objectives considering interplay between technology, economics, social and policy perspectives of sustainability.
PLO3	Model and optimize complex multi-energy systems for different end use applications.
PLO4	Critically examining existing body of knowledge to identify gaps and formulate innovative solutions and ideas for energy systems.

9. Map PLOs with Institute Learning Outcomes (ILOs) of the Degree

	PLO1	PLO2	PLO3	PLO4
ILO1	3	3	2	1
ILO2	2	3	3	2
ILO3	2	2	3	3
ILO4	1	1	2	3

[*Indicate '1' for weak, '2' for good, and '3' for excellent relation. Leave the cell blank to indicate no relation*]

10. Number of Department/~~Programme~~ Core Credits (project not included)	61
11. Number of Department / ~~Programme~~ Elective Credits	12
12. Number of Open Credits	9
13. Number of Project Core Credits	3

14. Details of Creative Expression and Ethical Reasoning (CEER) Component in the Programme [Only for UG]

Number of Credits Assigned	*5*
Courses Involved and Credits Accounted [*e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)*]	1. ESL3171: Design and Analysis of Energy Systems [3-0-0-3] (0.5 credits) 2. ESL3752: Hydrogen Economy [3-0-0-3] (0.5 credit) 3. ESL3873: Computational Methods for Energy Systems [2-0-2-3] (0.5 credit) 4. ESD4900: B. Tech. Project-1 [0-0-6-3] / ESD4950: Department Capstone Project [0-0-6-3] (2 credits) 5. ESP3460: Electrical Energy Laboratory [0-0-3-1.5]

	(0.5 credit) 6. ESP3110: Energy Innovation Laboratory [0-0-4-2] (1 credits)

15. Details of Emerging Trends (ETT) Component in the Programme [Only for UG]

Number of Credits Assigned	7
Courses Involved and Credits Accounted [*e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)*]	1. ESL3500: Plasma Concepts for Energy Applications [2-0-2-3] (0.5 credit) 2. ESL3752: Hydrogen Economy [3-0-0-3] (2 credits) 3. ESL3873: Computational Methods for Energy Systems [2-0-2-3] (0.5 credit) 4. ESD4900: B. Tech. Project-1 [0-0-6-3] / ESD4950: Department Capstone Project [0-0-6-3] (2 credits) 5. ESP3110: Energy Innovation Laboratory [0-0-4-2] (2 credits)

16. Details of Environment and Sustainability (E&S) Component in the Programme [Mandatory for UG]

Number of Credits Assigned	8.5
Courses Involved and Credits Accounted	1. ESL1000: Energy Resources and Utilization [3-1-0-4] (1 credit) 2. ESL3100: Energy Efficiency and Demand Side Management [3-0-0-3] (0.5 credits) 3. ESL3171: Design and Analysis of Energy Systems [3-0-0-3] (0.5 credit) 4. ESL3500: Plasma Concepts for Energy Applications [2-0-2-3] (0.5 credit) 5. ESL3641: Energy Storage [3-0-0-3] (0.5 credit) 6. ESL3752: Hydrogen Economy [3-0-0-3] (2 credits) 7. ESL3790: Economics, Planning and Financing of Energy Systems [3-0-0-3] (1 credits) 8. ESL3873: Computational Methods for Energy Systems [2-0-2-3] (0.5 credit)

	9. ESD4900: B. Tech. Project-1 [0-0-6-3] / ESD4950: Department Capstone Project [0-0-6-3] (1 credit) 10. ESP3110: Energy Innovation Laboratory [0-0-4-2] (1 credits)

17. Details of Research/Technical Communication Component in the Programme [Only for PG]

Number of Credits Assigned	NA
Courses Involved and Credits Accounted	1. -----

18. Details of Professional Ethics Component in the Programme [Only for PG]

Number of Credits Assigned	NA
Courses Involved and Credits Accounted	-------

19. Details of External Connect Component in the Programme [Only for PG]

Number of Credits Assigned	NA
Courses Involved and Credits Accounted	------

20. List of prescribed courses in all baskets (BS, GE, DC/PC, DE/PE, ...)

Basic Sciences (BS)			**General Engineering (GE)**			**Departmental/~~Programme~~ Core (DC/~~PC~~)**			**Departmental/~~Programme~~ Elective (DE/~~PE~~)**		
Course No	**Course Name**	**Credits [L-T-P-C]**	**Course No**	**Course Name**	**Credits [L-T-P-C]**	**Course No**	**Course Name**	**Credits [L-T-P-C]**	**Course No**	**Course Name**	**Credits [L-T-P-C]**
CML1001	Structural Insights into atoms and molecules	[2-1-0-3]	COL1000	Introduc-tion to Pro-gramming	[3-0-2-4]	ESL1000	Energy Resources and Utili-zation	[3-1-0-4]	ESL1040	Thermody-namics for Energy Systems	[3-1-0-4]
CMP1000	Chemistry Laboratory	[0-0-4-2]	ELL1000	Introduc-tion to Electrical Engineer-ing	[3-0-2-4]	ESL2020	Semicon-ductor for Energy Systems	[3-0-0-3]	ESL2105	Sustaina-ble devel-opment of the energy sector for society	[2-1-0-3]

MTL1001	Mathematics I: Calculus	[3-1-0-**4**]	MEP1000	Engineering Visualization	[0.5-0-3-**2**]	ESL2044	Thermo-Fluids for Energy Systems	[3-1-0-**4**]	ESL3130	Energy, Ecology and Environment	[3-1-0-**4**]
MTL1002	Mathematics II: Linear Algebra and Differential Equations	[3-1-0-**4**]	MEP1001	Manufacturing for Product Innovation	[0.5-0-3-**2**]	ESL2060	Circuit Analysis and Control Systems	[3-0-0-**3**]	ESL3160	Direct Energy Conversion Methods	[3-1-0-**4**]
PYL1001	Introduction to Electrodynamics	[2-1-0-**3**]	MEL1140	Thermodynamics	[3-0-2-**4**]	ESL2061	Electrical Machines	[3-0-0-**3**]	ESL3174	Smart Devices for Energy Harvesting	[3-0-0-**3**]
PYP1000	Physics Laboratory	[0-0-4-**2**]	MLL1001	Introduction to Materials Science and Engineering	[3-1-0-**4**]	ESL2100	Fundamental of Energy Engineering	[3-1-0-**4**]	ESL3175	IoT for Energy Systems	[3-0-0-**3**]
SBL1100	Biology for Engineers: Microbes in Health and Disease	[2-0-0-**2**]	GE6	Student option of BS courses	[3-1-0-**4**] / [3-0-2-**4**]	ESL2462	Electronics and Embedded Systems	[2-0-2-**3**]	ESL3177	Optimization of Energy System	[3-0-0-**3**]
SBP1100	Experimental Biology for Engineers	[0-0-2-**1**]				ESL2463	Power Electronics and Motor Drives	[3-1-0-**4**]	ESL3180	Basics of Nuclear Fission and Fusion	[3-1-0-**4**]
BS6	Student option of BS courses	[3-0-0-**3**] / [2-1-0-**3**] / [2-0-2-**3**]				ESL3100	Energy Efficiency and Demand Side Management	[3-0-0-**3**]	ESL3251	Fundamentals of Internal Combustion Engines	[3-0-0-**3**]
						ESL3171	Design and Analysis of Energy Systems	[3-0-0-**3**]	ESL3320	Building Integrated Photovoltaics	[3-0-0-**3**]
						ESL3172	Artificial Intelligence for Energy Systems	[3-0-0-**3**]	ESL3331	Hydrodynamic Machines	[3-1-0-**4**]
						ESL3464	Power System Modeling, Analysis and Control	[3-1-0-**4**]	ESL3581	Plasma Science	[3-1-0-**4**]
						ESL3500	Plasma Concepts for Energy Applications	[2-0-2-**3**]	ESL3582	Plasma Sources and Diagnostics	[3-0-0-**3**]
						ESL3641	Energy Storage	[3-0-0-**3**]	ESL3642	Nanotechnology in Energy	[3-0-0-**3**]

										Conversion and Storage	
						ESL3752	Hydrogen Economy	[3-0-0-**3**]	ESL3800	Self-organizing Dynamical Systems	[3-0-0-**3**]
						ESL3790	Economics, Planning and Financing of Energy Systems	[3-0-0-**3**]	ESL3876	Smart Buildings	[3-0-0-**3**]
						ESL3873	Computational Methods for Energy Systems	[2-0-2-**3**]	ESL4110	Waste to Energy	[3-0-0-**3**]
						ESD4900/ ESD4950	B. Tech Project-1/Department Capstone Project	[0-0-6-**3**]	ESL4250	Hybrid Vehicles	[3-0-0-**3**]
						ESP3100	Energy Engineering Lab	[0-0-3-**1.5**]	ESL4320	Industry Relevant Photovoltaic Technologies	[3-0-0-**3**]
						ESP3110	Energy Innovation Laboratory	[0-0-4-**2**]	ESL4390	Wind and Tidal Wave Energy	[3-0-0-**3**]
						ESP3460	Electrical Energy Laboratory	[0-0-3-**1.5**]	ESL4580	Plasma Chemistry	[3-0-0-**3**]
						ESD4901/ ESD4951 (Only for Honours Students)	B. Tech. Project-2 (ONLY for students with CGPA>8 and BTP-1/Corner stone project having grade B and above)	[0-0-24-**12**]	ESL4581	Plasma Based Technologies for Smart Materials	[3-0-0-**3**]
									ESL7132	Bioconversion and Processing of Waste	[3-0-0-**3**]
									ESL7176	Industrial Energy and Environment Analysis	[3-0-0-**3**]
									ESL7275	Liquid Sprays for Energy Sector and Industrial Applications	[3-0-0-**3**]

										ESL7281	Alternative Fuels for Aircraft and Rocket Propulsion	[3-0-0-**3**]
										ESL7349	Developing Energy Efficiency and Renewable Energy Projects	[2-0-2-**3**]
										ESL7369	Design of Wind Turbines	[2-0-2-**3**]
										ESL7421	Pulse Width Modulation Techniques and AC Motor Drives	[3-0-0-**3**]
										ESL7438	Power System Planning and Operation	[3-0-0-**3**]
										ESL7491	Renewable Energy Integration and Power Systems	[3-0-0-**3**]
										ESL7496	Operation and Control of Electrical Energy Systems	[3-0-0-**3**]
										ESL7498	Distributed and Decentralized Energy Systems	[3-0-0-**3**]
										ESL7750	Economics and Planning of Energy Systems	[3-0-0-**3**]
										ESL7756	Energy Policy and Planning	[3-0-0-**3**]
										ESL8845	Net Zero Energy Buildings	[3-0-0-**3**]
										ESD4980	Independent Study	[0-0-6-**3**]

21. Nominal Semester-wise Academic Plan [*An example is provided below*]

Proposed Semester wise Course Distribution: ES1

Plan B: Revised New Semester-Wise (with course merging) Course Structure for B. Tech. in Energy Engineering (ES1) Programme:

Semester 1 and Semester 2 are majorly Institute Core courses [IC: 63 (Basic Sciences [BS]:24, General Engineering [GE]: 24, Humanities and Social Sciences / Self Society and Wealth [HUSS/SSW]: 15)] with a total of 34 credits to be covered in the first year including one department core (Total Credits: 34 [DC: 4, DE: 0, OC: 0 , IC: 30 (BS:18, GE: 12, HUSS/SSW: 0)])

Semester 1 [Total Credits: 15.5 [DC: 0, DE: 0, OC: 0, IC: 0 (BS:9, GE:6.5, HUSS/SSW:0)]]

MTL1001: Mathematics I: Calculus [3-1-0-4] **{Mandatory BS : Mathematics course}**
CML1001: Structural Insights into atoms and molecules [2-1-0-3] **{Dept. BS2: Chemistry course}**
CMPXXXX: Chemistry Laboratory [0-0-4-2] **{Mandatory BS : Chemistry Practical course}**
COL0001: Computer Literacy [0-0-2-1] **{Mandatory GE : Computer course} [SEM 1A]**
COL1001 Introduction to Programming-Part 1 [1-0-1-**1.5**] **{Mandatory GE : Computer course} [SEM 1B]**
MCP1101: Manufacturing for Product Innovation [0.5-0-3-2] **{Department Suggested GE3}**
MCP1102: Engineering Visualization [0.5-0-3-2] **{Department Suggested GE2}**

Semester 2 [Total Credits: 18.5 [DC: 4, DE: 0, OC: 0, IC: 0 (BS:9, GE:5.5, HUSS/SSW:0)]]

MTL1002: Mathematics II: Linear Algebra and Differential Equations [3-1-0-4] **{Mandatory BS : Mathematics course}**
PYL1001: Introduction to Electrodynamics [2-1-0-3] **{Dept. BS1: Physics course}**
PYPXXXX: Physics Laboratory [0-0-4-2] **{Mandatory BS : Physics Practical course}**
COL1002 Introduction to Programming-Part 2 [1-0-1-**1.5**] **{Mandatory GE : Computer course} [SEM 2A/2B]**
ELL1000: Introduction to Electrical Engineering [3-0-2-4] **{Department Suggested GE1}**
ESL1100: Energy Resources and Utilization [3-1-0-**4**] **{Department Core Course (Small-size Class)}** [ES]

Semester 3 [Total Credits: 20 [DC: 9, DE: 0, OC: 0, IC: 11 (BS:3, GE:8, HUSS/SSW:0)]]

MCL1140: Thermodynamics [3-0-2-**4**] **{Dept. Recommended GE4}**
MLL1001: Introduction to Material Science and Engineering [3-0-2-4] **{Dept. Suggested GE4}**
ESL2020: Semiconductors for Energy Systems [3-0-0-3]
ESL2060: Circuit Analysis and Control Systems[3-0-0-3]
ESL2061: Electrical Machines [3-0-0-3]
BS4: Student Option of BS Course [3 credits] **{Student Choice BS4}**

Semester 4 [Total Credits: 22 [DC: 15, DE: 0, OC: 0, IC: 7 (BS:0, GE:4, HUSS/SSW:3)]]

ESL2044: Thermo-Fluids for Energy Systems [3-1-0-**4**]
ESL2100: Fundamentals of Energy Engineering [3-1-0-**4**]
ESL2462: Electronics and Embedded Systems [2-0-2-3] [CE, ET, ES]
ESL2463: Power Electronics and Motor Drives [3-1-0-**4**] [CE, ET, ES]
GE6: Student Option of GE Course [4 credits] **{Student Choice GE6}**
HULXXXX / SSWXXXX: Humanities and Social Sciences OR Self, Society and Wealth [3-0-0-3]

Semester 5 [Total Credits: 22 [DC: 19, DE: 0, OC: 0, IC: 3 (BS:0, GE:0, HUSS/SSW:3)]]

ESL3464: Power System Modelling, Analysis and Control [3-1-0-**4**] [CE, ET, ES]
ESL3500: Plasma Concepts for Energy Applications [2-0-2-3] [ET, ES]
ESL3641: Energy Storage [3-0-0-3] [CE, ET, ES]
ESL3790: Economics, Planning and Financing of Energy Systems [3-0-0-3] [CE, ET, ES]
ESL3873: Computational Methods for Energy Systems [2-0-2-3] [CE, ET, ES]
ESP3100: Energy Engineering Lab [0-0-3-**1.5**]
ESP3460: Electrical Energy Laboratory [0-0-3-**1.5**] [CE, ET, ES]
HULXXXX / SSWXXXX: Humanities and Social Sciences OR Self, Society and Wealth [3-0-0-3]

Semester 6 [Total Credits: 20 [DC: 14, DE: 0, OC: 0, IC: 6 (BS:3, GE:0, HUSS/SSW:3)]]

ESL3100: Energy Efficiency and Demand Side Management [3-0-0-3] [CE, ET, ES]
ESL3171: Design and Analysis of Energy Systems [3-0-0-3] [CE], ET, ES
ESL3172: Artificial Intelligence for Energy Systems [3-0-0-3] [CE, ET, ES]
ESL3752: Hydrogen Economy [3-0-0-3] [CE, ET, ES]
ESP3110: Energy Innovation Laboratory [0-0-4-2] [CE, ET, ES]
SBL1100: Biology for Engineers: Microbes in Health and Disease [2-0-0-2] **{Dept. BS3: Biology course}**
SBP1100: Experimental Biology for Engineers [0-0-2-1] **{Mandatory BS : Biology Practical course}**
HULXXXX / SSWXXXX: Humanities and Social Sciences OR Self, Society and Wealth [3-0-0-3]

Semester 7 [Total Credits: 15 [DC: 3, DE: 6, OC: 3, IC: 3 (BS:0, GE:0, HUSS/SSW:3)]]

ESD4900: B. Tech. Project-1 [0-0-6-3]/ ESD4950: Department Capstone Project [0-0-6-3] [CE, ES, ET]
DE-1 [**3 credits**]
DE-2 [**3 credits**]
OC-1 [**3 credits**]
HULXXXX / SSWXXXX: Humanities and Social Sciences OR Self, Society and Wealth [3-0-0-3]

Proposed Structure
(Total Credits: 148 [DC: 64, DE: 12, OC: 9, IC: 63 (Yr1: 48 (=24+24) + 15 HU)] + {additional 18 credits for students opting for B. Tech. Honours})

Semester 8 [Total Credits: 15/33[DC: 0/12, DE: 6/12, OC: 6, IC: 3 (BS:0, GE:0, HUSS/SSW:3)]]

DE-3 [Total: 3 **credits**]
DE 4 [Total: 3 **credits**]
OC-2 [**3 credits**]
OC-3 [**3 credits**]
HULXXXX / SSWXXXX: Humanities and Social Sciences OR Self, Society and Wealth [3-0-0-3]
ESD4900: B. Tech. Project-2 [0-0-24-12] AND DE-5 [Total: 3 **credits**]and DE-6 [Total: 3 **credits**]
{these additional 18 credits are **only for B. Tech. Honours Students**]

The overall credits structure for B. Tech. in Energy Engineering (Programme Code: ES1)

Overall Credit Structure:

Category	Institute Core				Department Courses			OC	Total Credits	CEER/ETT/ES		
	GE	BS	HU	SSW	DC (other than project)	DE	Project			CE	ETT	ES
Credits	24	24	9	6	61	12	3	9	148	20.5	26	23.5

DEPARTMENT OF ENERGY SCIENCE AND ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY DELHI

Proposed New Semester-Wise Course Structure for B. Tech. in Energy Engineering (ES1) Programme:

Semester	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	Course 8	Course 9	L	T	P	CE Credits	ES credits	ET credits	Contact Hours	Credits	Non-Grade Units
I	MTL1001 Mathematics I: Calculus 3 1 0 4	CML1001 Structural Insights into atoms and molecules 2 1 0 3	CMP9000X Chemistry Laboratory 0 0 4 2	MCP1101 Manufacturing for Product Innovation 0.5 0 3 2	MCP1102 Engineering Visualization 0.5 0 3 2	COL1000 Computer Literacy 0 0 2 1	COL1001 Introduction to Programming - Part 1 1 0 1 1.5			7.0	2.0	13.0	0.0	0.0	0.0	22.0	15.5	
Winter																		
II	MTL1002 Mathematics II: Linear Alegbra and Differential Equations 3 1 0 4	PYL0000X Introduction to Electrodynamics 2 1 0 3	PYP9000X Physcs Laboratory 0 0 4 2	ELL1000 Introduction to Electrical Engineering 3 0 2 4	COL1002 Introduction to Programming - Part 2 1 0 1 1.5	ESL1000 Energy Resources and Utilization 3 1 0 4 1				12.0	3.0	7.0	0.0	0.0	1.0	22.0	18.5	
Summer																		
III	MCL1140 Thermodynamics 3 0 2 4	MLL1001 Introduction to Materials Science and Engineering 3 1 0 4	ESL2020 Semiconductors for Energy Systems 3 0 0 3	ESL2060 Circuit Analysis and Control Systems 3 0 0 3 1 1 1	ESL2061 Electrical Machines 3 0 0 3 1 1 1			BS4 Student option of BS courses 3 0 0 3		18.0	1.0	2.0	2.0	2.0	2.0	21.0	20.0	
Winter																		
IV	ESL2042 Therma-Fluids for Energy Systems 3 1 0 4	ESL2100 Fundamentals of Energy Engineering 3 1 0 4	ESL2462 Electronics and Embedded Systems 2 0 2 3 2 2 1	ESL2463 Power Electronics and Motor Drives 3 1 0 4 2 2 2				GE5 Student option of GE courses 3 1 0 4	HUL0000X/SSM9000X 3 0 0 3	17.0	4.0	2.0	4.0	4.0	3.0	23.0	22.0	
Summer	Internship period																	
V	ESL3464 Power System Modeling, Analysis and control 3 1 0 4 2 2 2	ESL3500 Plasma Concepts for Energy Applications 2 0 2 3 1 1	ESL3641 Energy Storage 3 0 0 3 1 2 1	ESL3790 Economics, Planning and Financing of Energy Systems 3 0 0 3 0.5 1 2	ESL3873 Computational Methods for Energy Systems 2 0 2 3 0.5 1 0.5	ESP3100 Energy Engineering Lab 0 0 3 1.5	ESP3460 Electrical Energy Laboratory 0 0 3 1.5 1 1 1		HUL0000X/SSM9000X 3 0 0 3	16.0	1.0	10.0	5.0	8.0	7.5	27.0	22.0	
Winter	Internship period																	
VI	ESL3100 Energy Efficiency and Demand Side Management 3 0 0 3 1 2 2	ESL3171 Design and Analysis of Energy Systems 3 0 0 3 2 1 0.5	ESL3172 Artificial Intelligence for Energy Systems 3 0 0 3 1 2 0.5	ESL3752 Hydrogen Economy 3 0 0 3 0.5 2 2	ESP3110 Energy Innovation Laboratory 0 0 4 2 2 2 2		SBI1100 Biology for Engineers: Microbes in Health and Disease 2 0 0 2	SBP1100 Experiment Biology for Engineers 0 0 2 1	HUL0000X/SSM9000X 3 0 0 3	17.0	0.0	6.0	6.5	9.0	7.0	23.0	20.0	
Summer	Internship period																	
VII	ESD4900 / ESD 4950 B. Tech. Project - 1 / Department Capstone Project 0 0 6 3 3 3 3	DE-1 Department Elective - 1 3 0 0 3	DE-2 Department Elective - 2 3 0 0 3	OC-1 Open Category-1 3 0 0 3					HUL0000X/SSM9000X 3 0 0 3	12.0	0.0	6.0	3.0	3.0	3.0	18.0	15.0	
Winter	Placement Period																	
VIII		DE-3 Department Elective - 3 3 0 0 3	DE-4 Department Elective - 4 3 0 0 3	OC-2 Open Category-2 3 0 0 3	OC-3 Open Category-3 3 0 0 3				HUL0000X/SSM9000X 3 0 0 3	15.0	0.0	0.0	0.0	0.0	0.0	15.0	15.0	
Total										114.0	11.0	46.0	20.5	26.0	23.5	171.0	148.0	

VIII (Only for HONOURS STUDENTS)	ESD4901 / ESD 4951 B. Tech. Project - 2 (ONLY for students with CGPA > 8 and BTP-1 / Cornerstone project having grade B and above 0 0 24 12 12 12 3	DE-5 Department Elective - 5 3 0 0 3	DE-6 Department Elective - 6 3 0 0 3						6.0	0.0	24.0	12.0	12.0	3.0	30.0	18.0	
Total									120.0	11.0	70.0	32.5	38.0	26.5	201.0	166.0	

Institute Core (BS Basket): ES1					Institute Core (GE Basket): ES1			
CML1001	Structural Insights into atoms and molecules	[2-1-0]	3		COL1000	Introduction to Programming	[3-0-2]	4
CMPXXXX	Chemistry Laboratory	[0-0-4]	2		ELL1000	Introduction to Electrical Engineering	[3-0-2]	4
MTL 1001	Mathematics I: Calculus	[3-1-0]	4		MCP1000	Engineering Visualization	[0.5-0-3]	2
MTL1002	Mathematics II: Linear Algebra and Differential Equations	[3-1-0]	4		MCP1001	Manufacturing for Product Innovation	[0.5-0-3]	2
PYL1001	Introduction to Electrodynamics	[2-1-0]	3		MCL1140	Thermodynamics	[3-0-2]	4
PYP1000	Physics Laboratory	[0-0-4]	2		MLL1001	Introduction to Materials Science and Engineering	[3-1-0]	4

SBL1100	Biology for Engineers: Microbes in Health and Disease	[2-0-0]	2		GE6	Student option of GE courses	[3-1-0] / [3-0-2]	4
SBP1100	Experimental Biology for Engineers	[0-0-2]	1					
BS6	Student option of BS courses	[3-0-0] / [2-1-0] / [2-0-2]	3					
	Total BS		24			Total GE		24
Humanities [HU] [9 credits]					Self, Society and Wealth [SSW] [6 credits] [Two courses proposed from department]			
HUXXXX	Courses from Humanities Basket	9 credits	9		ESL2105	Sustainable development of the energy sector for society	[2-1-0]	3
	Minimum HU credits		9		SSWXXXX	Any other courses from SSW Basket of other departments		3
						Total SSW credits		6
Departmental Core (DC)					Departmental Electives (DE)			
ESL1000	Energy Resources and Utilization	[3-1-0]	4		ESL1040	Thermodynamics for Energy Systems	[3-1-0]	4
ESL2020	Semiconductor for Energy Systems	[3-0-0]	3		ESL3160	Direct Energy Conversion Methods	[3-1-0]	4
ESL2044	Thermo-Fluids for Energy Systems	[3-1-0]	4		ESL3174	Smart Devices for Energy Harvesting	[3-0-0]	3
ESL2100	Fundamental of Energy Engineering	[3-1-0]	4		ESL3175	IoT for Energy Systems	[3-0-0]	3
ESL2060	Circuit Analysis and Control Systems	[3-0-0]	3		ESL3177	Optimization of Energy System	[3-0-0]	3
ESL2061	Electrical Machines	[3-0-0]	3		ESL3180	Basics of Nuclear Fission and Fusion	[3-1-0]	4
ESL2462	Electronics and Embedded Systems	[2-0-2]	3		ESL3251	Fundamentals of Internal Combustion Engines	[3-0-0]	3
ESL2463	Power Electronics and Motor Drives	[3-1-0]	4		ESL3320	Building Integrated Photovoltaics	[3-0-0]	3
ESL3873	Computational Methods for Energy Systems	[2-0-2]	3		ESL3331	Hydrodynamic Machines	[3-1-0]	4
ESL3100	Energy Efficiency and Demand Side Management	[3-0-0]	3		ESL3581	Plasma Science	[3-1-0]	4
ESL3171	Design and Analysis of Energy Systems	[3-0-0]	3		ESL3582	Plasma Sources and Diagnostics	[3-0-0]	3
ESL3172	Artificial Intelligence for Energy Systems	[3-0-0]	3		ESL3642	Nanotechnology in Energy Conversion and Storage	[3-0-0]	3
ESL3464	Power System Modeling, Analysis and Control	[3-1-0]	4		ESL3800	Self-organizing Dynamical Systems	[3-0-0]	3
ESL3500	Plasma Concepts for Energy Applications	[2-0-2]	3		ESL3876	Smart Buildings	[3-0-0]	3
ESL3641	Energy Storage	[3-0-0]	3		ESL4110	Waste to Energy	[3-0-0]	3
ESL3752	Hydrogen Economy	[3-0-0]	3		ESL4250	Hybrid Vehicles	[3-0-0]	3
ESL3790	Economics, Planning and Financing of Energy Systems	[3-0-0]	3		ESL4320	Industry Relevant Photovoltaic Technologies	[3-0-0]	3
ESD4900 / ESD4950	B. Tech Project-I / Department Capstone Project	[0-0-6]	3		ESL4390	Wind and Tidal Wave Energy	[3-0-0]	3
ESD4901 / ESD4951 (Only for Honours Students)	B. Tech. Project-II (ONLY for students with CGPA>8 and B. Tech. Project-II / Corner stone project having grade B and above)	[0-0-24]	12		ESL4580	Plasma Chemistry	[3-0-0]	3
ESP3100	Energy Engineering Lab	[0-0-3]	1.5		ESL4581	Plasma Based Technologies for Smart Materials	[3-0-0]	3
ESP3110	Energy Innovation Laboratory	[0-0-4]	2		ESL7132	Bioconversion and Processing of Waste	[3-0-0]	3
ESP3460	Electrical Energy Laboratory	[0-0-3]	1.5		ESL7176	Industrial Energy and Environment Analysis	[3-0-0]	3
					ESL7275	Liquid Sprays for Energy Sector and Industrial Applications	[3-0-0]	3
					ESL7281	Alternative Fuels for Aircraft and Rocket Propulsion	[3-0-0]	3
					ESL7349	Developing Energy Efficiency and Renewable Energy Projects	[2-0-2]	3
					ESL7369	Design of Wind Turbines	[2-0-2]	3
	Total DC credits (without projects)		61		ESL7421	Pulse Width Modulation Techniques and AC Motor Drives	[3-0-0]	3
					ESL7438	Power System Planning and Operation	[3-0-0]	3
					ESL7491	Renewable Energy Integration and Power Systems	[3-0-0]	3
					ESL7496	Operation and Control of Electrical Energy Systems	[3-0-0]	3
					ESL7498	Distributed and Decentralized Energy Systems	[3-0-0]	3
					ESL7742	Economics and Financing of Renewable Energy Systems	[3-0-0]	3

					ESL7750	Economics and Planning of Energy Systems	[3-0-0]	3
					ESL7756	Energy Policy and Planning	[3-0-0]	3
					ESL8845	Net Zero Energy Buildings	[3-0-0]	3
					ESD4980	Independent Study	[0-0-6]	3

For above course numbers of format ESLWXYZ, the first number (W) is the level of the course whereas the second number (X) will indicate particular areas and will be the following:

1. **Fundamentals**: X = 0
2. **Energy & Environment**: X = 1
3. **Combustion**: X = 2
4. **Renewable Energy Technology**: X = 3
5. **Electrical Energy and Renewable Energy Power Systems**: X = 4
6. **Plasma Science and Technology**: X = 5
7. **Energy Storage**: X = 6
8. **Energy Economics**: X = 7
9. **Other Areas**: X = 8
10. **Projects**: X = 9

22. Average Contact Hours per Faculty *per Week,* for this Programme	$\frac{(contact\ hours\ of\ DC + DE) \times (number\ of\ batches)}{(number\ of\ semesters) \times (faculty\ strength)} = \frac{87 \times 4}{7 \times 19}$ $\approx 2.62\ \frac{contact\ hours}{faculty - week}$
23. Average Credit Students per Faculty per Semester, for this Programme	$\frac{(Total\ credits\ of\ DC + DE) \times (number\ of\ batches) \times (number\ of\ students\ per\ batch)}{(number\ of\ semesters) \times (faculty\ strength)}$ $= \frac{87 \times 4 \times 40}{7 \times 19} \approx 104.7\ \frac{Average\ credit\ Students}{faculty - semester}$
24. If the program is a revision of an existing program, please list the major changes made.	✓ Total number of credits have been reduced from 157 to 148 with reduced core courses (67 credits reduced to 64 credits) and increased department electives (10 credits increased to 12 credits). ✓ More tutorial components have been added to some of the courses based on discussions with students and faculty. ✓ Based on student requests, there are now no core courses in the seventh semester to accommodate student placements. ✓ Major changes in core courses: ➢ The MCL242 (Heat and Mass Transfer) course and APL105 (Mechanics of solids and fluids) have been merged to one course, ESL2044 (Thermo-Fluids for Energy Systems).

	➢ All Electrical Relevant courses have been accommodated within 18.5 credits, including the practical component. ➢ Credits of some core courses have been reduced. ➢ Energy Engineering Lab is now a separate core course with increased credits. ➢ Practical credits in Energy Engineering Lab and Energy Innovation Lab has been increased by 0.5 credits. ✓ Inclusion of choice capstone projects. ✓ All course contents are revised as per discussion with faculty board, alumni and student representatives and other stakeholders including industry.
25. Please elaborate on,	
a) how flexibility for the students has increased?	✓ Increased contact hours for Do-It-Yourself Energy Innovative Lab course ✓ More Department elective courses are available for students to choose as per their area of interest. ✓ Reduced credits in last two semesters allowing students to undertake placement related activities and additional courses. ✓ More tutorial components have been added to some of the courses based on discussions with students and faculty. ✓ Inclusion of choice capstone projects. ✓ Both student choice (BS and GE courses are slotted for third and fourth semester respectively). This will help them plan for their internships also. ✓ Based on student requests, there are now no core courses in the seventh semester to accommodate student placements. ✓
b) how engagement and interaction with the student have increased?	✓ Increased tutorial hours compared to lecture hours. ✓ Classroom demonstration, lab and industry visits undertaken periodically.

	✓ The Tutorial and Practical Credits have been increased, even in the Energy Innovation Lab, which is a Do-It-Yourself (DIY) course.
c) how hands-on learning is emphasized in the program?	✓ The Energy Innovation Lab is a practical lab that is completely attributed to hands-on learning and creative thinking for developing energy-sector relevant models. The contact hours has now been increased from 3 hours to 4 hours ✓ Apart from this five other practical laboratories are there in the core course.