

# Programme Template

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| 1. Name of the Programme and Code                                                                    | <b><i>Bachelor of Technology in Energy Engineering</i></b><br>Undergraduate Programme<br><b>ES1</b>                                                                                                    |
| 2. Degree (UG/PG)                                                                                    | UG                                                                                                                                                                                                     |
| 3. Minimum Duration of the Programme<br>(Specify for FT and PT, if applicable)                       | 4 years, FT                                                                                                                                                                                            |
| 4. Maximum Duration of the Programme<br>(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<br>Involved as Teaching Faculty in the Programme                | 19 regular faculty at DESE, IIT Delhi (As of April 30, 2025) + 5<br>faculty (on deputation / retiring this year)                                                                                       |
| 7. Minimum Credit Requirements for the Degree                                                        | 148                                                                                                                                                                                                    |
| 8. Articulate the Program Learning Outcomes (PLO): <i>Graduates of this program will be able to:</i> |                                                                                                                                                                                                        |
| <b>Abbreviation</b>                                                                                  | <b>Description</b>                                                                                                                                                                                     |
| 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.                                                               |
| <b>Abbreviation</b>                                                                                  | <b>Description</b>                                                                                                                                                                                     |
| 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 |
|-------------|------|------|------|------|
| <b>ILO1</b> | 3    | 3    | 2    | 1    |
| <b>ILO2</b> | 2    | 3    | 3    | 2    |
| <b>ILO3</b> | 2    | 2    | 3    | 3    |
| <b>ILO4</b> | 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]

|                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                |
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| Number of Credits Assigned                                                                                                                                | 20.5                                                                                                                                                                                                                                                                                                                                                                                           |
| Courses Involved and Credits Accounted<br><i>[e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]</i> | <ol style="list-style-type: none"> <li>1. ESL2060: Circuit Analysis and Control [3-0-0-3] (1 credit)</li> <li>2. ESL2061; Electrical Machines [3-0-0-3] (1 credit)</li> <li>3. ESL2462: Electronics and Embedded systems [2-0-2-3] (2 credits)</li> <li>4. ESL2463: Power Electronics and Motor Drives [3-1-0-4] (2 credits)</li> <li>5. ESL3100: Energy Efficiency and Demand Side</li> </ol> |

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|  |  | <p>Management [3-0-0-3] (1 credit)</p> <p>6. ESL3171: Design and Analysis of Energy Systems [3-0-0-3] (2 credits)</p> <p>7. ESL3172: Artificial Intelligence for Energy Systems [3-0-0-3] (1 credit)</p> <p>8. ESL3464: Power System Modelling, Analysis and Control [3-1-0-4] (2 credits)</p> <p>9. ESL3641: Energy Storage [3-0-0-3] (1 credit)</p> <p>10. ESL3752: Hydrogen Economy [3-0-0-3] (0.5 credit)</p> <p>11. ESL3790: Economics, Planning and Financing of Energy Systems [3-0-0-3] (0.5 credit)</p> <p>12. ESL3873: Computational Methods for Energy Systems [2-0-2-3] (0.5 credit)</p> <p>13. ESD4900: B. Tech. Project-1 [0-0-6-3]/ ESD4950: Department Capstone Project [0-0-6-3] (3 credits)</p> <p>14. ESP3460: Electrical Energy Laboratory [0-0-3-1.5] (1 credit)</p> <p>15. ESP3110: Energy Innovation Laboratory [0-0-4-2] (2 credits)</p> |
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15. Details of Emerging Trends (ETT) Component in the Programme [Only for UG]

| Number of Credits Assigned                                                                                                                                           | 26                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <p>Courses Involved and Credits Accounted</p> <p><i>[e.g., If one module in AMLXXX with contact hours YY satisfies Z credits, then write AMLXXX (Z credits)]</i></p> | <p>1. ESL2060: Circuit Analysis and Control [3-0-0-3] (1 credit)</p> <p>2. ESL2061; Electrical Machines [3-0-0-3] (1 credit)</p> <p>3. ESL2462: Electronics and Embedded systems [2-0-2-3] (2 credits)</p> <p>4. ESL2463: Power Electronics and Motor Drives [3-1-0-4] (2 credits)</p> <p>5. ESL3100: Energy Efficiency and Demand Side Management [3-0-0-3] (2 credits)</p> <p>6. ESL3171: Design and Analysis of Energy Systems [3-0-0-3] (1 credit)</p> |

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|  | <p>7. ESL3172: Artificial Intelligence for Energy Systems [3-0-0-3] (2 credits)</p> <p>8. ESL3464: Power System Modelling, Analysis and Control [3-1-0-4] (2 credits)</p> <p>9. ESL3500: Plasma Concepts for Energy Applications [2-0-2-3] (1 credit)</p> <p>10. ESL3641: Energy Storage [3-0-0-3] (2 credits)</p> <p>11. ESL3752: Hydrogen Economy [3-0-0-3] (2 credits)</p> <p>12. ESL3790: Economics, Planning and Financing of Energy Systems [3-0-0-3] (1 credit)</p> <p>13. ESL3873: Computational Methods for Energy Systems [2-0-2-3] (1 credit)</p> <p>14. ESD4900: B. Tech. Project-1 [0-0-6-3]/ ESD4950: Department Capstone Project [0-0-6-3] (3 credits)</p> <p>15. ESP3460: Electrical Energy Laboratory [0-0-3-1.5] (1 credit)</p> <p>16. ESP3110: Energy Innovation Laboratory [0-0-4-2] (2 credits)</p> |
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16. Details of Environment and Sustainability (E&S) Component in the Programme [Mandatory for UG]

| Number of Credits Assigned             | 18.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Courses Involved and Credits Accounted | <p>1. ESL1000: Energy Resources and Utilization [3-1-0-4] (1 credit)</p> <p>2. ESL2060: Circuit Analysis and Control [3-0-0-3] (1 credit)</p> <p>3. ESL2061: Electrical Machines [3-0-0-3] (1 credit)</p> <p>4. ESL2462: Electronics and Embedded systems [2-0-2-3] (1 credit)</p> <p>5. ESL2463: Power Electronics and Motor Drives [3-1-0-4] (2 credits)</p> <p>6. ESL3100: Energy Efficiency and Demand Side Management [3-0-0-3] (2 credits)</p> <p>7. ESL3171: Design and Analysis of Energy Systems [3-</p> |

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|  | <p>0-0-3] (0.5 credit)</p> <p>8. ESL3172: Artificial Intelligence for Energy Systems [3-0-0-3] (0.5 credit)</p> <p>9. ESL3464: Power System Modelling, Analysis and Control [3-1-0-4] (2 credits)</p> <p>10. ESL3500: Plasma Concepts for Energy Applications [2-0-2-3] (1 credit)</p> <p>11. ESL3641: Energy Storage [3-0-0-3] (1 credit)</p> <p>12. ESL3752: Hydrogen Economy [3-0-0-3] (2 credits)</p> <p>13. ESL3790: Economics, Planning and Financing of Energy Systems [3-0-0-3] (2 credits)</p> <p>14. ESL3873: Computational Methods for Energy Systems [2-0-2-3] (0.5 credit)</p> <p>15. ESD4900: B. Tech. Project-1 [0-0-6-3]/ ESD4950: Department Capstone Project [0-0-6-3] (3 credits)</p> <p>16. ESP3460: Electrical Energy Laboratory [0-0-3-1.5] (1 credit)</p> <p>17. ESP3110: Energy Innovation Laboratory [0-0-4-2] (2 credits)</p> |
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**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]                         | COL0001                  | Computer Literacy                                 | [0-0-2-1]         | ESL1000                             | Energy Resources and Utilization             | [3-1-0-4]         | ESL1040                                 | Thermodynamics for Energy Systems                        | [3-1-0-4]         |
| CMPXXX X            | Chemistry Laboratory                                      | [0-0-4-2]                         | COL1001                  | Introduction to Programming Part 1                | [1-0-1-1.5]       | ESL2020                             | Semiconductor for Energy Systems             | [3-0-0-3]         | ESL2105                                 | Sustainable development of the energy sector for society | [2-1-0-3]         |
| MTL 1001            | Mathematics I: Calculus                                   | [3-1-0-4]                         | COL1002                  | Introduction to Programming Part 2                | [1-0-1-1.5]       | 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]                         | ELL1000                  | Introduction to Electrical Engineering            | [3-0-2-4]         | ESL2060                             | Circuit Analysis and Control Systems         | [3-0-0-3]         | ESL3160                                 | Direct Energy Conversion Methods                         | [3-1-0-4]         |
| PYLXXX X            | Introduction to Electrodynamics                           | [2-1-0-3]                         | MCP1101                  | Manufacturing for Product Innovation              | [0.5-0-3-2]       | ESL2061                             | Electrical Machines                          | [3-0-0-3]         | ESL3174                                 | Smart Devices for Energy Harvesting                      | [3-0-0-3]         |
| PYPXXX X            | Physics Laboratory                                        | [0-0-4-2]                         | MCP1102                  | Engineering Visualization                         | [0.5-0-3-2]       | 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]                         | MCL1140                  | Thermodynamics                                    | [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]                         | MLL1001                  | Introduction to Materials Science and Engineering | [3-1-0-4]         | ESL2463                             | Power Electronics and Motor Drives           | [3-1-0-4]         | ESL3180                                 | Basics of Nuclear Fission and Fusion                     | [3-1-0-4]         |
| BSL6                | Student option of BS courses                              | [3-0-0-3] / [2-1-0-3] / [2-0-2-3] | GEL6                     | Student option of BS courses                      | [3-1-0-4]         | 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                  | [3-0-0-3]         | ESL3331                                 | Hydrodynamic Machines                                    | [3-1-0-4]         |

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|  |  |  |  |  |  |                                                    | Energy Systems                                                                                             |             |         |                                                 |           |  |
|  |  |  |  |  |  | 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 Conversion and Storage | [3-0-0-3] |  |
|  |  |  |  |  |  | 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/<br>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/<br>ESD4951<br>(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] |  |

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|  |  |  |  |  |  |  |  |  | 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] |

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|  |  |  |  |  |  |  |  |  |  | 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:

|                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |  |                                                                                                                                                                     |  |  |  |  |  |  |  |
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| 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)]]                                                                                                                                                                                                                                                                                      |  |  |  |  | Semester 2 [Total Credits: 18.5 [DC: 4, DE: 0, OC: 0, IC: 0 (BS:9, GE:5.5, HUSS/SSW:0)]]                                                                            |  |  |  |  |  |  |  |
| MTL1001: Mathematics I: Calculus [3-1-0-4] {Mandatory BS : Mathematics course}                                                                                                                                                                                                                                                                                                |  |  |  |  | MTL1002: Mathematics II: Linear Algebra and Differential Equations [3-1-0-4] {Mandatory BS : Mathematics course}                                                    |  |  |  |  |  |  |  |
| CML1001: Structural Insights into atoms and molecules [2-1-0-3] {Dept. BS2: Chemistry course}                                                                                                                                                                                                                                                                                 |  |  |  |  | PYP1001: Introduction to Electrodynamics [2-1-0-3] {Dept. BS1: Physics course}                                                                                      |  |  |  |  |  |  |  |
| CMPXXX: Chemistry Laboratory [0-0-4-2] {Mandatory BS : Chemistry Practical course}                                                                                                                                                                                                                                                                                            |  |  |  |  | PYPXXX: Physics Laboratory [0-0-4-2] {Mandatory BS : Physics Practical course}                                                                                      |  |  |  |  |  |  |  |
| COL0001: Computer Literacy [0-0-2-1] {Mandatory GE : Computer course} [SEM 1A]                                                                                                                                                                                                                                                                                                |  |  |  |  | COL1002 Introduction to Programming-Part 2 [1-0-1-1.5] {Mandatory GE : Computer course} [SEM 2A/2B]                                                                 |  |  |  |  |  |  |  |
| COL1001 Introduction to Programming-Part 1 [1-0-1-1.5] {Mandatory GE : Computer course} [SEM 1B]                                                                                                                                                                                                                                                                              |  |  |  |  | ELL1000: Introduction to Electrical Engineering [3-0-2-4] {Department Suggested GE1}                                                                                |  |  |  |  |  |  |  |
| MCP1101: Manufacturing for Product Innovation [0.5-0-3-2] {Department Suggested GE3}                                                                                                                                                                                                                                                                                          |  |  |  |  | ESL1100: Energy Resources and Utilization [3-1-0-4] {Department Core Course (Small-size Class)} [ES]                                                                |  |  |  |  |  |  |  |
| MCP1102: Engineering Visualization [0.5-0-3-2] {Department Suggested GE2}                                                                                                                                                                                                                                                                                                     |  |  |  |  |                                                                                                                                                                     |  |  |  |  |  |  |  |
| Semester 3 [Total Credits: 20 [DC: 9, DE: 0, OC: 0, IC: 11 (BS:3, GE:8, HUSS/SSW:0)]]                                                                                                                                                                                                                                                                                         |  |  |  |  | Semester 4 [Total Credits: 22 [DC: 15, DE: 0, OC: 0, IC: 7 (BS:0, GE:4, HUSS/SSW:3)]]                                                                               |  |  |  |  |  |  |  |
| MCL1140: Thermodynamics [3-0-2-4] {Dept. Recommended GE4}                                                                                                                                                                                                                                                                                                                     |  |  |  |  | ESL2044: Thermo-Fluids for Energy Systems [3-1-0-4]                                                                                                                 |  |  |  |  |  |  |  |
| MLL1001: Introduction to Material Science and Engineering [3-0-2-4] {Dept. Suggested GE4}                                                                                                                                                                                                                                                                                     |  |  |  |  | ESL2100: Fundamentals of Energy Engineering [3-1-0-4]                                                                                                               |  |  |  |  |  |  |  |
| ESL2020: Semiconductors for Energy Systems [3-0-0-3]                                                                                                                                                                                                                                                                                                                          |  |  |  |  | ESL2462: Electronics and Embedded Systems [2-0-2-3] [CE, ET, ES]                                                                                                    |  |  |  |  |  |  |  |
| ESL2060: Circuit Analysis and Control Systems [3-0-0-3]                                                                                                                                                                                                                                                                                                                       |  |  |  |  | ESL2463: Power Electronics and Motor Drives [3-1-0-4] [CE, ET, ES]                                                                                                  |  |  |  |  |  |  |  |
| ESL2061: Electrical Machines [3-0-0-3]                                                                                                                                                                                                                                                                                                                                        |  |  |  |  | GE6: Student Option of GE Course [4 credits] {Student Choice GE6}                                                                                                   |  |  |  |  |  |  |  |
| BS4: Student Option of BS Course [3 credits] {Student Choice BS4}                                                                                                                                                                                                                                                                                                             |  |  |  |  | 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)]]                                                                                                                                                                                                                                                                                         |  |  |  |  | Semester 6 [Total Credits: 20 [DC: 14, DE: 0, OC: 0, IC: 6 (BS:3, GE:0, HUSS/SSW:3)]]                                                                               |  |  |  |  |  |  |  |
| ESL3464: Power System Modelling, Analysis and Control [3-1-0-4] [CE, ET, ES]                                                                                                                                                                                                                                                                                                  |  |  |  |  | ESL3100: Energy Efficiency and Demand Side Management [3-0-0-3] [CE, ET, ES]                                                                                        |  |  |  |  |  |  |  |
| ESL3500: Plasma Concepts for Energy Applications [2-0-2-3] [ET, ES]                                                                                                                                                                                                                                                                                                           |  |  |  |  | ESL3171: Design and Analysis of Energy Systems [3-0-0-3] [CE, ET, ES]                                                                                               |  |  |  |  |  |  |  |
| ESL3641: Energy Storage [3-0-0-3] [CE, ET, ES]                                                                                                                                                                                                                                                                                                                                |  |  |  |  | ESL3172: Artificial Intelligence for Energy Systems [3-0-0-3] [CE, ET, ES]                                                                                          |  |  |  |  |  |  |  |
| ESL3790: Economics, Planning and Financing of Energy Systems [3-0-0-3] [CE, ET, ES]                                                                                                                                                                                                                                                                                           |  |  |  |  | ESL3752: Hydrogen Economy [3-0-0-3] [CE, ET, ES]                                                                                                                    |  |  |  |  |  |  |  |
| ESL3873: Computational Methods for Energy Systems [2-0-2-3] [CE, ET, ES]                                                                                                                                                                                                                                                                                                      |  |  |  |  | ESP3110: Energy Innovation Laboratory [0-0-4-2] [CE, ET, ES]                                                                                                        |  |  |  |  |  |  |  |
| ESP3100: Energy Engineering Lab [0-0-3-1.5]                                                                                                                                                                                                                                                                                                                                   |  |  |  |  | SBL1100: Biology for Engineers: Microbes in Health and Disease [2-0-0-2] {Dept. BS3: Biology course}                                                                |  |  |  |  |  |  |  |
| ESP3460: Electrical Energy Laboratory [0-0-3-1.5] [CE, ET, ES]                                                                                                                                                                                                                                                                                                                |  |  |  |  | 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]                                                                                                                                                                                                                                                                                       |  |  |  |  | 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)]]                                                                                                                                                                                                                                                                                          |  |  |  |  | Semester 8 [Total Credits: 15/33[DC: 0/12, DE: 6/12, OC: 6, 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-3 [Total: 3 credits]                                                                                                                                             |  |  |  |  |  |  |  |
| DE-1 [3 credits]                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  | DE 4 [Total: 3 credits]                                                                                                                                             |  |  |  |  |  |  |  |
| DE-2 [3 credits]                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  | OC-2 [3 credits]                                                                                                                                                    |  |  |  |  |  |  |  |
| OC-1 [3 credits]                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  | OC-3 [3 credits]                                                                                                                                                    |  |  |  |  |  |  |  |
| HULXXXX / SSWXXXX: Humanities and Social Sciences OR Self, Society and Wealth [3-0-0-3]                                                                                                                                                                                                                                                                                       |  |  |  |  | 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:**

| Source                          | Course 1                                                                                                                            | Course 2                                                     | Course 3                                              | Course 4                                                       | Course 5                                            | Course 6                                    | Course 7                                                        | Course 8                                    | Course 9        | L     | T    | P    | CE Credit | ES credit | ET credit | Content Hours | Credit | Non-Grade Credit |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------|---------------------------------------------|-----------------|-------|------|------|-----------|-----------|-----------|---------------|--------|------------------|
| I                               | MTH1001<br>Mathematics I: Calculus                                                                                                  | CML1001<br>Structural Insights into atoms and molecules      | CMPXXXX<br>Chemistry Laboratory                       | MCP1101<br>Manufacturing for Product Innovation                | MCP1102<br>Engineering Visualization                | COL000<br>Computer Literacy                 | COL100<br>Introduction to Programming - Part 1                  |                                             |                 | 7.0   | 2.0  | 13.0 | 0.0       | 0.0       | 0.0       | 22.0          | 15.5   |                  |
| Winter                          | MTL1002<br>Mathematics II: Linear Algebra and Differential Equations                                                                | PYLXXXX<br>Introduction to Electrodynamics                   | PYPXXXX<br>Physics Laboratory                         | ELL1000<br>Introduction to Electrical Engineering              | COL1002<br>Introduction to Programming - Part 2     | ESL1000<br>Energy Resources and Utilization |                                                                 |                                             |                 | 12.0  | 3.0  | 7.0  | 0.0       | 0.0       | 1.0       | 22.0          | 18.5   |                  |
| Summer                          | MCL1140<br>Thermodynamics                                                                                                           | MCL1001<br>Introduction to Materials Science and Engineering | ESL2020<br>Semiconductors for Energy Systems          | BSL2060<br>Circuit Analysis and Control Systems                | BSL2061<br>Electrical Machines                      |                                             | BSA<br>Student option of BS courses                             |                                             |                 | 38.0  | 1.0  | 2.0  | 2.0       | 2.0       | 2.0       | 21.0          | 20.0   |                  |
| Winter                          | ESL2042<br>Thermo-Fluids for Energy Systems                                                                                         | BSL2100<br>Fundamentals of Energy Engineering                | ESL2462<br>Electronics and Embedded Systems           | BSL2463<br>Power Electronics and Motor Drive                   |                                                     |                                             | GES<br>Student option of GE courses                             | PLSXXXX/SSSXXXX                             |                 | 17.0  | 4.0  | 2.0  | 4.0       | 4.0       | 3.0       | 23.0          | 22.0   |                  |
| Summer                          | ESL3444<br>Power System Modeling Analysis and control                                                                               | BSL3500<br>Plasma Concepts for Energy Applications           | ESL3641<br>Energy Storage                             | BSL3760<br>Economics, Planning and Financing of Energy Systems | BSL3872<br>Computational Methods for Energy Systems | BEP3100<br>Energy Engineering Lab           | BEP3460<br>Electrical Energy Laboratory                         | PLSXXXX/SSSXXXX                             |                 | 16.0  | 1.0  | 10.0 | 5.0       | 8.0       | 7.5       | 27.0          | 22.0   |                  |
| Winter                          | ESL3100<br>Energy Efficiency and Demand Side Management                                                                             | BSL3171<br>Design and Analysis of Energy Systems             | ESL3172<br>Artificial Intelligence for Energy Systems | BSL3752<br>Hydrogen Economy                                    | BEP3130<br>Energy Innovation Laboratory             |                                             | SBL100<br>Biology for Engineers: Microbes in Health and Disease | SBL1100<br>Experiment Biology for Engineers | PLSXXXX/SSSXXXX | 17.0  | 0.0  | 6.0  | 6.5       | 9.0       | 7.0       | 23.0          | 20.0   |                  |
| Summer                          | ESD4500 / ESD 4051<br>B. Tech. Project -1/ Department Capstone Project                                                              | DE-1<br>Department Elective - 1                              | DE-2<br>Department Elective - 2                       | OC-1<br>Open Category-1                                        |                                                     |                                             |                                                                 | PLSXXXX/SSSXXXX                             |                 | 12.0  | 0.0  | 6.0  | 3.0       | 3.0       | 3.0       | 18.0          | 15.0   |                  |
| Winter                          |                                                                                                                                     | DE-3<br>Department Elective - 3                              | DE-4<br>Department Elective - 4                       | OC-2<br>Open Category-2                                        | OC-3<br>Open Category-3                             |                                             |                                                                 | PLSXXXX/SSSXXXX                             |                 | 15.0  | 0.0  | 0.0  | 0.0       | 0.0       | 0.0       | 15.0          | 15.0   |                  |
| VII (Only for HONOURS STUDENTS) | ESD4501 / ESD 4051<br>B. Tech. Project -2 (ONLY for students with CGPA > 8 and BTP-3)/ Cornerstone project having grade B and above | DE-5<br>Department Elective - 5                              | DE-6<br>Department Elective - 6                       |                                                                |                                                     |                                             |                                                                 |                                             |                 | 6.0   | 0.0  | 24.0 | 12.0      | 12.0      | 3.0       | 30.0          | 38.0   |                  |
| Total                           |                                                                                                                                     |                                                              |                                                       |                                                                |                                                     |                                             |                                                                 |                                             |                 | 114.0 | 11.0 | 46.0 | 20.5      | 26.0      | 25.5      | 171.0         | 148.0  |                  |

**Institute Core (BS Basket): ES1**

| Course Code | Course Name                                               | Prerequisites | Credits | Course Code | Course Name                            | Prerequisites | Credits |
|-------------|-----------------------------------------------------------|---------------|---------|-------------|----------------------------------------|---------------|---------|
| CML1001     | Structural Insights into atoms and molecules              | [2-1-0]       | 3       | COL0001     | Computer Literacy                      | [0-0-2]       | 1       |
| CMPXXXX     | Chemistry Laboratory                                      | [0-0-4]       | 2       | COL1001     | Introduction to Programming Part 1     | [1-0-1]       | 1.5     |
| MTL 1001    | Mathematics I: Calculus                                   | [3-1-0]       | 4       | COL1002     | Introduction to Programming Part 2     | [1-0-1]       | 1.5     |
| MTL1002     | Mathematics II: Linear Algebra and Differential Equations | [3-1-0]       | 4       | ELL1000     | Introduction to Electrical Engineering | [3-0-2]       | 4       |
| PYLXXXX     | Introduction to Electrodynamics                           | [2-1-0]       | 3       | MCP1101     | Manufacturing for Product Innovation   | [0.5-0-3]     | 2       |
| PYPXXXX     | Physics Laboratory                                        | [0-0-4]       | 2       | MCP1102     | Engineering Visualization              | [0.5-0-3]     | 2       |
| SBL1100     | Biology for Engineers: Microbes in Health and Disease     | [2-0-0]       | 2       | MCL1140     | Thermodynamics                         | [3-0-2]       | 4       |

|                                             |                                                                                                            |                                   |           |                                                                                   |         |                                                             |         |           |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------|-----------------------------------------------------------------------------------|---------|-------------------------------------------------------------|---------|-----------|
| SBP1100                                     | Experimental Biology for Engineers                                                                         | [0-0-2]                           | 1         |                                                                                   | MLL1001 | Introduction to Materials Science and Engineering           | [3-1-0] | 4         |
| BSL6                                        | Student option of BS courses                                                                               | [3-0-0] /<br>[2-1-0] /<br>[2-0-2] | 3         |                                                                                   | GEL6    | Student option of BS courses                                | [3-1-0] | 4         |
|                                             | <b>Total BS</b>                                                                                            |                                   | <b>24</b> |                                                                                   |         | <b>Total GE</b>                                             |         | <b>24</b> |
| 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         |
|                                             | <b>Minimum HU credits</b>                                                                                  |                                   | <b>9</b>  |                                                                                   | SSWXXXX | Any other courses from SSW Basket of other departments      |         | 3         |
|                                             |                                                                                                            |                                   |           |                                                                                   |         | <b>Total SSW credits</b>                                    |         | <b>6</b>  |
| 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-1/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-2 (ONLY for students with CGPA>8 and BTP-1/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         |
|                                             | <b>Total DC credits (without projects)</b>                                                                 |                                   | <b>61</b> |                                                                                   | 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. <b>Combustion:</b> X = 2<br>4. <b>Renewable Energy Technology:</b> X = 3<br>5. <b>Electrical Energy and Renewable Energy Power Systems:</b> X = 4<br>6. <b>Plasma Science and Technology:</b> X = 5<br>7. <b>Energy Storage:</b> X = 6<br>8. <b>Energy Economics:</b> X = 7<br>9. <b>Other Areas:</b> X = 8<br>10. <b>Projects:</b> X = 9 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 22. Average Contact Hours per Faculty <i>per Week</i> , for this Programme                                                                                                                                                                                                                                                                   | $\frac{(\text{contact hours of DC} + \text{DE}) \times (\text{number of batches})}{(\text{number of semesters}) \times (\text{faculty strength})} = \frac{87 \times 4}{7 \times 19}$ $\approx 2.62 \frac{\text{contact hours}}{\text{faculty} - \text{week}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 23. Average Credit Students per Faculty per Semester, for this Programme                                                                                                                                                                                                                                                                     | $\frac{(\text{Total credits of DC} + \text{DE}) \times (\text{number of batches}) \times (\text{number of students per batch})}{(\text{number of semesters}) \times (\text{faculty strength})}$ $= \frac{87 \times 4 \times 40}{7 \times 19} \approx 104.7 \frac{\text{Average credit Students}}{\text{faculty} - \text{semester}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 24. If the program is a revision of an existing program, please list the major changes made.                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>✓ 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).</li> <li>✓ More tutorial components have been added to some of the courses based on discussions with students and faculty.</li> <li>✓ Based on student requests, there are now no core courses in the seventh semester to accommodate student placements.</li> <li>✓ Major changes in core courses: <ul style="list-style-type: none"> <li>➤ The MLL1001 (Introduction to Material Science and Engineering) course and ESL2020 (Semiconductors for Energy Systems have been merged to one course).</li> <li>➤ A General Engineering course has been included by the Department: “ESL1020: Mechanics of Solids and Fluids for Engineering Applications”.</li> <li>➤ All Electrical Relevant courses have been accommodated within 18.5 credits, including the practical component.</li> <li>➤ Credits of some core courses have been reduced.</li> <li>➤ Energy Engineering Lab is now a separate core course with increased credits.</li> </ul> </li> </ul> |

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

|  |                                                                                                                                                                                                                |
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|  | <p>for developing energy-sector relevant models. The contact hours has now been increased from 3 hours to 4 hours</p> <p>✓ Apart from this five other practical laboratories are there in the core course.</p> |
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