| Course Code | 21GNH101J | Course Title | PHILOSOPHY OF ENGINEERING | Course Category | O | Open Elective Course | L | T | P | C |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 | 0 | 1 | 2 |

| Course Learning Rationale (CLR) | The purpose of learning this course is to: |
|---|---|
| CLR-1 | Inspire a holistic overview of engineering |
| CLR-2 | Enlighten the methods and methodologies for building ontologies for systems engineering |
| CLR-3 | Acquaint with engineering knowledge, building engineering knowledge and value of engineering |
| CLR-4 | Upskill the engineering design process in aspects of conceive, design, implement and operate methodology |
| CLR-5 | Instill the role of engineers in society, code of ethics and socio-politics of technology and engineering |
| CLR-6 | Utilize the aspects of philosophical enquiry to examine and analyze the nature and impact of engineering work |

| Course Learning Outcomes (CLO) | At the end of this course, learners will be able to: | Learning Depth: Conceive | Design | Implement | Operate | Attainment: Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | PLO 1 Engineering Knowledge | PLO 2 Problem Analysis | PLO 3 Design & Development | PLO 4 Analysis, Design, Research | PLO 5 Modern Tool Usage | PLO 6 Society & Culture | PLO 7 Environment & Sustainability | PLO 8 Ethics | PLO 9 Individual & Team Work | PLO 10 Communication | PLO 11 Project Mgt. & Finance | PLO 12 Life Long Learning | PSO - 1 | PSO - 2 | PSO - 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO-1 | Analyze the relation between Arts, Mathematics, Science, Technology and Engineering and desired attributes of an engineer | ✓ | | | | 2 | 85 | 75 | L | - | - | H | - | L | - | L | H | H | - | H | - | - | - |
| CLO-2 | Build ontologies for systems engineering using concept/mind mapping techniques | ✓ | ✓ | ✓ | | 2 | 85 | 75 | H | - | - | H | H | - | - | - | H | H | - | H | - | - | - |
| CLO-3 | Analyze the knowledge base in engineering, distinctive features of engineering design and RIASEC model | | ✓ | | | 2 | 85 | 75 | H | - | - | H | - | - | - | - | H | H | - | H | - | - | - |
| CLO-4 | Illustrate the engineering design process for the given application, analyze the requirements of CDIO engineers | ✓ | ✓ | ✓ | ✓ | 2 | 85 | 75 | H | L | M | H | H | - | - | - | H | H | - | H | - | - | - |
| CLO-5 | Evaluate designs on their environmental and societal aspects and do organizational analysis on profession engineering organizations | ✓ | ✓ | | | 3 | 85 | 75 | H | H | M | H | - | H | H | H | H | H | - | H | - | - | - |
| CLO-6 | Examine and Analyze the nature and impact of engineering work using philosophical enquiry | ✓ | ✓ | ✓ | ✓ | 3 | 85 | 75 | H | M | L | H | M | M | L | M | H | H | - | H | - | - | - |

| Learning Content | | Introduction to Philosophy of Engineering | Ontology of Engineering | Epistemology of Engineering | Methodology of Engineering | Axiology of Engineering |
|---|---|---|---|---|---|---|
| Duration (hour) | | 6 | 6 | 6 | 6 | 6 |
| S-1 | SLO-1 | Define Engineering | Ontology | Relations between Science, Technology and Engineering | Difference between Scientific Method and Engineering Design (ADDIE) | Engineering and Society |
| | SLO-2 | History of Engineering Development | Reference Ontology and Application Ontology | Questions on Philosophy of Engineering | CDIO Engineers in Industry | Engineers Code of Ethics |
| S-2 | SLO-1 | Practice 1: Compare Prehistory, Medieval and Present Engineering Development | Practice 4: Reference Ontology using Concept/Mind Mapping | Practice 7: Analyze the nature, contents and complexity of the knowledge base in engineering | Practice 10: Relate ADDIE and CDIO Methodology | Practice 13: Evaluate Popular Inventions and apply their new point of view to Re-Design |
| | SLO-2 | | | | | |
| S-3 | SLO-1 | Relation between Arts, Mathematics, Science, Technology and Engineering | Suites of Ontology Modules | Four Dimensions of Engineering | Conceive and Design | Sustainability and Diversity |
| | SLO-2 | STEAM Pyramid | Functions and Capabilities | RAISEC Model | Engineering Design Process | Engineer's role to achieve Sustainable Development |
| S-4 | SLO-1 | Practice 2: STEAM Pyramid Analysis: Is Art Context Necessary? | Practice 5: Engineering Application Ontology using Concept/Mind Mapping | Practice 8: Case Study on RAISEC Theory of Career Choice | Practice 11: Illustrate the Engineering Design Process for the given Application | Practice 14: Case Study on Achieving Sustainable Development Goals |
| | SLO-2 | | | | | |
| S-5 | SLO-1 | Desired Attributes of an Engineer | Product Life Cycle | Epistemology of Engineering Design | Implement and Operate | Socio-Politics of Technology & Engineering |
| | SLO-2 | Engineering Habits of Mind | Commodities, Services and Infrastructure | Rigour, Creativity and Change in Engineering | Operational Factors in System Design | Professional Engineering Organizations |
| S-6 | SLO-1 | Practice 3: Case Study on Attributes of an Engineer | Practice 6: Product Life Cycle Ontology using Concept/Mind Mapping | Practice 9: Analyze Distinctive Features of Epistemology of Engineering Design | Practice 12: Analyze the Requirements of Operational Engineers | Practice 15: Case Study on Professional Engineering Organizations |
| | SLO-2 | | | | | |

**Learning Resources**


1. Louis L. Bucciarelli, Engineering Philosophy, Illustrated, DUP Satellite, 2007
2. Gregory Bassett, Philosophical Perspectives of Engineering and Technology Literacy, I, Original writing Ltd, 2014
3. Philosophy of Engineering, Volume I, Royal Academic of Engineering (UK), 2010
4. Christensen, S.H, Engineering Identities, Epistemologies and Values, Springer, 2015
5. Van De Poel, Ibo, Philosophy and Engineering, An Emerging Agenda, Springer, 2010
6. Diane P. Michelfilder, The Routeledge Handbook of The Philosophy of Engineering, Routledge, 2020

**Learning Assessment**

| Bloom's Level of Thinking | | Continuous Learning Assessment (50% weightage) | | | | | | | | | | Final Exam (50% weightage) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CLO–1 (10%) | | CLO–2 (10%) | | CLO–3 (10%) | | CLO–4 (10%) | | CLO–5 (10%) | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 20% | 20% |
| | Understand | | | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 10% | 10% |
| | Create | | | | | | | | | | | | |
| Total | | 100 % | | 100 % | | 100 % | | 100 % | | 100 % | | 100 % | |

**Learning Strategies** (Pedagogy / Andragogy / Heutagogy / Ergonagy etc..)

| | | | | | |
|---|---|---|---|---|---|
| Audience Polling | | Game Based Learning | | Progressive Inquiry | ✓ |
| Brainstorming | ✓ | Group Discussion | ✓ | Puzzle | |
| Case Studies | ✓ | Hands-on Practice | | Role-Play | |
| Clarification Pauses | | Inquiry Learning | ✓ | Service Learning | |
| Charts / Flowchart / Models | ✓ | Interactive Lecture | ✓ | Self-Assessment | |
| Concept Map | ✓ | Leading Question | | Simulation / Emulation | |
| Debate | ✓ | Mind Map | ✓ | Snowball | ✓ |
| Experiential Learning | | Minute Paper | | Think-Pair-Share | ✓ |
| Field Work | | Peer Review | ✓ | Thematic Analysis | |
| Flipped Learning | | Problem Based Learning | ✓ | Worksheet | ✓ |

**Learning Course Designers**

| Experts from Industry | | Experts from Higher Professional Institutions | | Internal Experts | |
|---|---|---|---|---|---|
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