1. **Course Outcomes**

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| **Theory of Computation (BTCS-702)** |
| 1. Describe Chomsky classification of formal languages or grammars and their associated machines. (K1) 2. Explain the methods of formal reasoning about languages. (K2) 3. Compare different computational models using combinatorial methods. (K2) 4. Illustrate the concept of parsing and its relation to various problems. (K3) 5. Explain the concepts of decidability, finiteness and equivalence with respect to computation. (K2) 6. Summarize the capabilities of Finite Automata, Pushdown Automata, Linear Bounded Automata and Turing Machines. (K2) |

1. **Mapping of COs with POs, Course with POs, COs with PSOs and Course with PSOs along with justification**

**Table 2: COs-POs Mapping Matrix**

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| **COs/ Pos** | **Program Outcomes (POs)** | | | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **CO I** | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 3 |
| **CO II** | 2 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| **CO III** | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| **CO IV** | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
| **CO V** | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| **CO VI** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |

**Table 3: COs-PSOs Mapping Matrix**

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| **COs/ PSOs** | **Program Specific Outcomes (PSOs)** | | |
| **PSO 1** | **PSO 2** | **PSO 3** |
| **CO I** | 2 | 3 | 2 |
| **CO II** | 1 | 1 | 2 |
| **CO III** | 3 | 3 | 3 |
| **CO IV** | 2 | 3 | 3 |
| **CO V** | 1 | 2 | 3 |
| **CO VI** | 3 | 3 | 3 |

**Table 4: Course-POs Mapping Matrix**

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| **Course/ Pos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|  | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |

**Table 5: Course-PSOs Mapping Matrix**

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| **Course/PSOs** | **PSO 1** | **PSO 2** | **PSO 3** |
|  | 2 | 3 | 3 |

**Justification**

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| **COI** | **POs** | **Mapping** | **Justification** |
| PO1 | 2 | It moderately correlates because mathematical concepts of grammars, languages and their machines help to find the solutions of engineering problems. |
| PO2 | 3 | It highly correlates because they facilitate to identify and analyze the complex problems whose solutions can be formulated with the help of machines |
| PO3 | 3 | It highly correlates because the knowledge of various formal languages and their associated machines help to design apprpriate solutions and system components. |
| PO4 | 3 | It highly correlates as languages and machines are helpful in providing valid conclusions |
| PO5 | 2 | It moderately correlates because use of machines help to identify the modern technology or tools. |
| PO6 | 1 | It slightly correlates because limited application of reasoning is used to assesses various aspects. |
| PO7 | 2 | It moderately correlates because the knowledge of machines and their languages helps to demonstrate the knowledge and need of sustainable development. |
| PO8 | 1 | It slightly correlates because use of machines in society should consider the professional ethics. |
| PO9 | 1 | It slightly correlates as use of machines help an individual to work effectively. |
| PO10 | 2 | It moderately correlates because understanding of grammars and machines enable us to effectively communicate with society or engineering community. |
| PO11 | 2 | It moderately correlates as it helps to acquire knowledge and understanding of engineering principles and their applications. |
| PO12 | 3 | It highly correlates because fundamental knowledge of how to use languages and grammars is a lifelong learning for an individual. |

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| **COII** | **POs** | **Mapping** | **Justification** |
| PO1 | 2 | It moderately correlates because formal or mathematical reasoning help to find solutions of engineering problems. |
| PO2 | 3 | It highly correlates because formal reasoning can be applied to dentify and analyze the problems. |
| PO3 | 2 | It moderately correlates because reasoning after analyzing problems help to find system solutions |
| PO4 | 3 | It highly correlates because it facilitates in interpretation of data to reach valid conclusions. |
| PO5 | 1 | It slightly correlates as it helps to identify the tools and technologies used for solving problems. |
| PO6 | 1 | It slightly correlates because methods of reasoning assesses societal, health and safety issues. |
| PO7 | 1 | It slightly correlates because it helps to understand the impact of machines on society. |
| PO8 | 1 | It slightly correlates as it is less influenced by ehical principles |
| PO9 | 1 | It slightly correlates because it is understanding of an individual. |
| PO10 | 1 | It slightly correlates because methods of reasoning has to do little in aspect of communication or presentation |
| PO11 | 1 | It slightly correlates as there is need to coordinate & manage work according to engineering principles |
| PO12 | 2 | It moderately correlates because an individual gains knowledge which can be useful in using machines throughout lifetime. |

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| **COIII** | **POs** | **Mapping** | **Justification** |
| PO1 | 2 | It moderately correlates because comparison of machines using combinatorial methods helps to have the knowledge of mathematics in solving engineering problems. |
| PO2 | 3 | It highly correlates as computational models and combinatorial methods help to analyze the given problem effectively. |
| PO3 | 3 | It highly correlates because understanding of computational models help us to design appropriate solutions to meet specified needs. |
| PO4 | 2 | It moderately correlates because the acquired knowledge from combinatorial methods helps in analyzing and synthesis of the information provide valid conclusions |
| PO5 | 2 | It moderately correlates because use of computational models will be helpful in applying the apprpriate tools and techniques in different types of problems. |
| PO6 | 2 | It moderately correlates its understanding and application takes care of society, safety, legal issues & consequent responsibilities. |
| PO7 | 2 | It moderately correlates because knowledge of these will help to choose optimal solutions without unnecessary waste of resources. |
| PO8 | 1 | It slightly correlates because its application ensures the commitment to ethical principles. |
| PO9 | 2 | It moderately correlates because effective individual and team work is required to do comparison of various models. |
| PO10 | 2 | It moderately correlates because effective communication and documentation is required for using combinatorial methods on computational models |
| PO11 | 2 | It moderately correlates because engineering principles are need to be adhered while working with computational models |
| PO12 | 3 | It highly correlates because understanding and knowledge of computational models will be reflected throughout life |

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| **COIV** | **POs** | **Mapping** | **Justification** |
| PO1 | 3 | It highly correlates because parsing concept is helpful in acquiring knowledge of mathematics,science and engineering to solve any complex engineering problem. |
| PO2 | 2 | It moderately correlates because parsers help to analyze the problem properly. |
| PO3 | 3 | It highly correlates because it gives solutions considering public health and safety. |
| PO4 | 3 | It highly correlates because parsers provide valid conclusions. |
| PO5 | 3 | It highly correlates because the latest techniques and tools are used in parsing. |
| PO6 | 2 | It moderately correlates as parsing provide software solutions which has impact on society. |
| PO7 | 2 | It moderately correlates because it helps to understand solution for sustainable development. |
| PO8 | 1 | It slightly correlates because the ethical principles are applied while generating parsers. |
| PO9 | 2 | It moderately correlates because team work is required to solve problems using parsers. |
| PO10 | 2 | It moderately correlates because one need to communicate to experts while working wih parsers |
| PO11 | 2 | It moderately correlates because effective management principles are required to apply parsing in different projects. |
| PO12 | 3 | It highly correlates because working with parsing to solve problems enhance life long learning of an individual. |

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| **COV** | **POs** | **Mapping** | **Justification** |
| PO1 | 2 | It moderately correlates because it helps to have engineering knowledge to solve complex problems. |
| PO2 | 2 | It moderately correlates because decidability with rwspect to computation helps to analyze problems using concepts of mathematics. |
| PO3 | 2 | It moderately correlates because concepts of computation are helpful to design solutions. |
| PO4 | 2 | It moderately correlates as finiteness, equivalence are research based concepts that are used to analyze the data. |
| PO5 | 2 | It moderately correlates because the latest techniques are used computation. |
| PO6 | 1 | It slightly correlates because computation affects safety and society issues. |
| PO7 | 1 | It slightly correlates because these concepts provide environment friendly knowledge for sustainable development. |
| PO8 | 1 | It moderately correlates because various concepts of computation requires involvement of ethical principles. |
| PO9 | 2 | It moderately correlates because effective individual effort and team work is needed during performing decidability along with computation |
| PO10 | 2 | It moderately correlates because communication is mandatory while performing finiteness and equivalence with respect to computation |
| PO11 | 2 | It moderately correlates because proper principles of management are required to apply various concepts of computation in various disciplines. |
| PO12 | 3 | It highly correlates because these concepts help a lot in compuatational knowledge throughout life time. |

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| **COVI** | **POs** | **Mapping** | **Justification** |
| PO1 | 3 | It highly correlates because all machines are mathematical which help to solve different kinds of enineering problems. |
| PO2 | 3 | It highly correlates because the problem is analyzed thoroughly before applying these analytical machines. |
| PO3 | 3 | It highly correlates because a solution is being designed based on the capabilities of machines. |
| PO4 | 3 | It highly correlates because these lead to investigate the complex problems reaching valid solutions. |
| PO5 | 3 | It highly correlates because latest techniques are used by such machines. |
| PO6 | 2 | It moderately correlates because these assess the responsibilities relevant to engineering practice. |
| PO7 | 2 | It moderately correlates because these use of machines lead to sustainable development in engineering field. |
| PO8 | 2 | It moderately correlates because professional ethics are exhibited while using capabilities of automata in different fields. |
| PO9 | 2 | It moderately correlates because effective effort of the team is required while solving complex engineering problems. |
| PO10 | 2 | It moderately correlates as it requires to communicate with each other and to design documentation of each solution which can be easily understandable. |
| PO11 | 3 | It highly correlates because to acquire the desired results in different applications, we need to use concepts of engineering and management. |
| PO12 | 3 | It highly correlates because understanding and application of different automata in multidisciplinary fields help an engineer to have life long learning. |

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| **COI** | **PSOs** | **Mapping** | **Justification** |
| PSO1 | 2 | It moderately correlates because the acquired knowledge of machines is possible only with understanding of the software and hardware aspects of the computer system |
| PSO2 | 3 | It highly correlates because knowledge of grammars and machines enables the use of tools and techniques. |
| PSO3 | 2 | It moderately correlates because the mathematical concepts of grammars and machines help in the application of algorithms to solve real world problems. |

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| **COII** | **PSOs** | **Mapping** | **Justification** |
| PSO1 | 1 | It slightly correlates because the various aspects of the software system should be clear for formal reasoning of languages. |
| PSO2 | 1 | It slightly correlates because various tools are required for reasoning. |
| PSO3 | 2 | It moderately correlates because formal resoning of languages involves mathematical concepts. |

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| **COIII** | **PSOs** | **Mapping** | **Justification** |
| PSO1 | 3 | It highly correlates because comparison of computational models is possible only with the knowledge of software and hardware aspects of the systems. |
| PSO2 | 3 | It highly correlates because combinatorial methods involve the use of skills and modern tools, techniques. |
| PSO3 | 3 | It highly correlates because algorithmic and mathematical concepts get clear using combinatorial methods of comparison of machines. |
| **COIV** | **PSOs** | **Mapping** | **Justification** |
| PSO1 | 2 | It moderately correlates because parsing concepts require understanding of software systems. |
| PSO2 | 3 | It highly correlates as parsing enables the use of latest tools and techniques to solve problems. |
| PSO3 | 3 | It highly correlates because various mathematical & computational concepts are applied for designing parsers |

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| **CO V** | **PSOs** | **Mapping** | **Justification** |
| PSO1 | 1 | It slightly computational aspects involves understanding of software and hardware systems. |
| PSO2 | 2 | It moderately correlates because concepts of decidability, equivalence, finiteness also inculcates the use of skills for doing computations |
| PSO3 | 3 | It highly correlates because these are mathematical concepts which help to apply algorithms on various real world problems |

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| **CO VI** | **PSOs** | **Mapping** | **Justification** |
| PSO1 | 3 | It highly correlates because the understanding of these automata and their applications require the knowledge of all the aspects of software and hardware systems. |
| PSO2 | 3 | It highly correlates because new tools and techniques are applied to perform computations of these automata |
| PSO3 | 3 | It highly correlates because various algorithms and mathematical concepts are used by different automata in different applications to solve problems. |