# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

Dundigal, Hyderabad - 500 043

## COMPUTER SCIENCE AND ENGINEERING

### TUTORIAL QUESTION BANK

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| **Course Name** | WASTE TO ENERGY |
| **Course Code** | BCSB30 |
| **Class** | M. Tech III Sem |
| **Branch** | CSE |
| **Year** | 2019 – 2020 |
| **Team of Instructors** | Ms. Ch Srividya, Assistant Professor |

## COURSE OBJECTIVES:

**The course should enable the students to:**

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| I | Understand the principles associated with effective energy management and to apply these principles in the day to day life |
| II | Develop insight into the collection, transfer and transport of municipal solid waste |
| III | Explain the design and operation of a municipal solid wasteland fill. |
| IV | Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities. |

## COURSE OUTCOMES (COs):

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| CO 1 | Describe basic concepts of waste to energy resources and their conversion devices. |
| CO 2 | Understand the concept of pyrolysis and the production of different products by using pyrolysis |
| CO 3 | Explore different types of biomass gasification techniques and understand Biochemical conversion of biomass for energy application |
| CO 4 | Explore different types of biomass combustion techniques and their working operations. |
| CO 5 | Describe the basic concepts of biogas and explore Biogas plant technology and their applications. |

## COURSE LEARNING OUTCOMES (COs):

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| BCSB30.01 | Explain about different types of waste to energy resources. |
| BCSB30.02 | Understand basic concept of energy conversion and explore different types of conversion devices. |
| BCSB30.03 | Understand basic concept of pyrolosis and their types. |
| BCSB30.04 | Describe the concept of manufacture of charcoal, and their Methods. |
| BCSB30.05 | Describe the concept of manufacture of pyrolytic oils and gases and their applications. |
| BCSB30.06 | Describe the concept of biomass gasification technique and their gasification types and techniques. |
| BCSB30.07 | Explain about the Gasifier engine arrangement for the production of electrical power and their considerations. |
| BCSB30.08 | Understand about the concept of biomass combustion through some exotic designs . |
| BCSB30.09 | Explore on various combustion techniques and their operations. |
| BCSB30.10 | Understand about the basic concepts of biogas. |

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| BCSB30.11 | Demonstrate about Biogas plant technology and Bio energy system. |
| BCSB30.12 | Explain about the concept of Alcohol production from biomass and Bio diesel production. |
| BCSB30.13 | Discuss about the Biomass energy program in India. |

## TUTORIAL QUESTION BANK

### PART – A (SHORT ANSWER QUESTIONS)

| S. No | QUESTIONS | Blooms Taxonomy Level | Course Outcome | Course Learning Outcome |
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| | **UNIT – I<br>INTRODUCTION TO ENERGY FROM WASTE** | | | |
| **PART – A (SHORT ANSWER QUESTIONS)** | | | | |
| 1. | What is meant by solid waste Management? | Understand | CO1 | BCSB30.1 |
| 2. | Give the composition of Municipal solid waste. | Knowledge | CO1 | BCSB30.1 |
| 3. | What is industrial waste? | Understand | CO1 | BCSB30.1 |
| 4. | State the prerequisites of an effective system of solid waste management. | Analyze | CO1 | BCSB30.1 |
| 5. | What are the functional elements in a typical solid waste management system? | Understand | CO1 | BCSB30.1 |
| 6. | What is integrated solid waste management? | Understand | CO1 | BCSB30.1 |
| 7. | Define MSW? | Analyze | CO1 | BCSB30.1 |
| 8. | Define "solid waste". State its types? | Analyze | CO1 | BCSB30.2 |
| 9. | How will you determine the moisture content of the solid waste? | Analyze | CO1 | BCSB30.2 |
| 10. | List out various conversion devices? | Remember | CO1 | BCSB30.2 |
| 11. | List the various advantages of waste segregation? | Remember | CO1 | BCSB30.2 |
| 12. | What are incinators? Explain it'sworking procedure. | Understand | CO1 | BCSB30.2 |
| 13. | Define gasifiers.what are the different types of gasifiers? | Understand | CO1 | BCSB30.2 |
| 14. | What are digestors? Explain it'sworking procedure. | Understand | CO1 | BCSB30.2 |
| 15. | Define waste minimization and recycling of MSW? | Knowledge | CO1 | BCSB30.2 |
| **PART – B (LONG ANSWER QUESTIONS)** | | | | |
| 1. | Explain the process of Classification of waste as fuel. | Understand | CO1 | BCSB30.1 |
| 2. | How can the heat from an energyfrom waste facility be used? | Analyze | CO1 | BCSB30.1 |
| 3. | Where will the waste for any proposed energy from waste facility come from? | Understand | CO1 | BCSB30.1 |
| 4. | Is energy from waste a renewable energy source? | Analyze | CO1 | BCSB30.1 |
| 5. | Do energy from waste facilities undermine efforts to improve recycling? | Understand | CO1 | BCSB30.1 |
| 6. | What is Agro based waste and how to recycle that waste? | Understand | CO1 | BCSB30.1 |
| 7. | How do proposals for energy from waste developments fit in with the Scottish Government's Zero Waste Plan? | Knowledge | CO1 | BCSB30.1 |
| 8. | What is forest residue and explain the methods to use forest residue? | Understand | CO1 | BCSB30.2 |
| 9. | What are the applications for energy from waste facilities? | Understand | CO1 | BCSB30.2 |
| 10. | How to minimize industrial waste and explain the process of converting waste to energy? | Analyze | CO1 | BCSB30.2 |
| 11. | What is the role and responsibility of local authorities in the planning process of MSW? | Analyze | CO1 | BCSB30.2 |
| 12. | What happens if MSW planning permission is not granted? | Understand | CO1 | BCSB30.2 |
| 13. | What happens if MSW planning permission is granted? | Understand | CO1 | BCSB30.2 |
| 14 | Explain different conversion devices of waste to energy? | Understand | CO1 | BCSB30.2 |
| 15. | Distinguish between Incinerators, gasifiers and digestors? | Analyze | CO1 | BCSB30.2 |
| | **UNIT – II<br>BIOMASS PYROLYSIS** | | | |
| **PART – A (SHORT ANSWER QUESTIONS)** | | | | |
| 1. | Define biomass. | Remember | CO2 | BCSB30.3 |

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| 2. | What kinds of biomass can be used to generate fuel and products? | Understand | CO2 | BCSB30.3 |
| 3. | What is the current economic value of biofuels produced domestically? | Understand | CO2 | BCSB30.3 |
| 4. | How much biomass could we sustainably produce here in our states? | Analyze | CO2 | BCSB30.3 |
| 5. | Define biomass pyrolysis. | Analyze | CO2 | BCSB30.4 |
| 6. | How will we efficiently grow, collect, and transport the bulky, dispersed biomass required for biofuels? | Analyze | CO2 | BCSB30.4 |
| 7. | Why aren't more farmers collecting agricultural residue or growing energy crops to make biofuels right now? | Understand | CO2 | BCSB30.4 |
| 8. | What are the different types of biomass pyrolysis? | Understand | CO2 | BCSB30.4 |
| 9. | What is an yield and explain briefly how to produce an yield? | Understand | CO2 | BCSB30.5 |
| 10. | What is pyrolytic oil and explain briefly which gases are used to produce it? | Understand | CO2 | BCSB30.5 |
| 11. | What is charcoal? | Understand | CO2 | BCSB30.5 |
| 12. | Explain briefly about slow pyrolysis? | Understand | CO2 | BCSB30.4 |
| 13. | Explain briefly about fast pyrolysis? | Understand | CO2 | BCSB30.4 |
| 14. | List out the different methods used to produce charcoal. | Analyze | CO2 | BCSB305 |
| 15. | What are the different applications of yields? | Understand | CO2 | BCSB30.5 |
| **PART – B (LONG ANSWER QUESTIONS)** | | | | |
| 1. | What is Waste Processing? | Understand | CO2 | BCSB30.3 |
| 2. | How does energy recovery relate to renewable energy? | Analyze | CO2 | BCSB30.3 |
| 3. | Define pyrolytic oil and explain the process of manufacture of pyrolytic oil. | Analyze | CO2 | BCSB30.3 |
| 4. | Explain the process of producing charcoal from pyrolysis. | Understand | CO2 | BCSB30.4 |
| 5. | What is the best way to manage our trash? | Understand | CO2 | BCSB30.3 |
| 6. | Explain the working process of producing pyrolytic gas. | Understand | CO2 | BCSB30.4 |
| 7. | What kinds of biomass can be used to generate fuel and products? | Understand | CO2 | BCSB30.4 |
| 8. | Define biomass and Explain the process of biomass pyrolysis. | Remember | CO2 | BCSB30.4 |
| 9. | What is the current economic value of biofuels produced domestically? | Understand | CO2 | BCSB30.4 |
| 10. | How much biomass could we sustainably produce here in the states? | Analyze | CO2 | BCSB30.4 |
| 11. | Distinguish between slow and fast biomass pyrolysis? | Understand | CO2 | BCSB30.4 |
| 12. | How will we efficiently grow, collect, and transport the bulky, dispersed biomass required for biofuels? | Analyze | CO2 | BCSB30.3 |
| 13. | Why aren't more farmers collecting agricultural residue or growing energy crops to make biofuels right now? | Remember | CO2 | BCSB30.3 |
| 14. | What is anyield and explain the different types of yields? | Understand | CO2 | BCSB305 |
| 15. | Explain briefly about the methods to produce charcoal. | Understand | CO2 | BCSB30.4 |
| **UNIT – III<br>BIOMASS GASIFICATION** | | | | |
| **PART – A (SHORT ANSWER QUESTIONS)** | | | | |
| 1. | What is Biomass Gasifier? | Understand | CO3 | BCSB30.6 |
| 2. | What are the different types of gases generated from the Gasifier? | Remember | CO3 | BCSB30.6 |
| 3. | Explain briefly about the working process of Gasifier ? | Analyze | CO3 | BCSB30.6 |
| 4. | What is the maximum working temperature achievable with producer gas/Gasifier? | Understand | CO3 | BCSB30.6 |
| 5. | How much wood does a gasifier consume? | Analyze | CO3 | BCSB30.6 |
| 6. | Does the Producer Gas contain sulphur or other harmful gases? | Analyze | CO3 | BCSB30.6 |
| 7. | Is there any pulsation/fluctuation in gas production in gasifiers? | Remember | CO3 | BCSB30.6 |
| 8. | What is fixed bed system gasification process? | Understand | CO3 | BCSB30.7 |
| 9. | What is downdraft gasifier? | Understand | CO3 | BCSB30.7 |

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| 10. | What are the benefits of installing a gasifier? | Understand | CO3 | BCSB30.7 |
| 11. | What is updraft gasifier? | Remember | CO3 | BCSB30.7 |
| 12. | Will the installation of gasifier make the work area dirty/unhygienic? | Remember | CO3 | BCSB30.7 |
| 13. | Define gasifier and explain about Fluidized bed gasifier? | Understand | CO3 | BCSB30.7 |
| 14. | What is thermal heating and List out what are the different types of gases produced in thermal heating? | Remember | CO3 | BCSB307 |
| 15. | Define gasifier burner? | Remember | CO3 | BCSB30.7 |
| **PART – B (LONG ANSWER QUESTIONS)** | | | | |
| 1. | Do we need skilled personnel for operating the gasifier? | Remember | CO3 | BCSB30.6 |
| 2. | What is the quality of required wood for gasifier operation? | Remember | CO3 | BCSB30.6 |
| 3. | Explain the process of biomass gasification. | Understand | CO3 | BCSB30.6 |
| 4. | What is the Gasifier burner arrangement for thermalheating. | Understand | CO3 | BCSB30.7 |
| 5. | Explain the process of fixed bed gasification. | Remember | CO3 | BCSB30.7 |
| 6. | Distinguish between Downdraft and updraft gasifiers? | Analyze | CO3 | BCSB30.7 |
| 7. | What are the different types of considerations in gasifier operation? | Understand | CO3 | BCSB30.7 |
| 8. | What is the process of Fluidized bed gasification? | Understand | CO3 | BCSB30.7 |
| 9. | Explain the process of thermal heating for gasification. | Remember | CO3 | BCSB30.7 |
| 10. | How isgasification is more advantageous than pyrolysis and liquefaction? | Remember | CO3 | BCSB30.7 |
| 11 | Explain briefly the types of Biomass gasification. | Remember | CO3 | BCSB30.6 |
| 12 | How should be the Gasifier engine arrangement in gasification? | Analyze | CO3 | BCSB30.7 |
| 13 | How to produce electric power from biomass gasification? | Analyze | CO3 | BCSB30.7 |
| 14 | Which method of gasification has more advantages than other gasification methods? | Understand | CO3 | BCSB30.7 |
| 15 | Explain about the construction and operation of Fluidized bed gasifiers. | Remember | CO3 | BCSB30.7 |
| **UNIT – IV<br>BIOMASS COMBUSTION** | | | | |
| **PART – A (SHORT ANSWER QUESTIONS)** | | | | |
| 1. | Why a Manitoba Biomass Energy Support Program (MBESP)? | Analyze | CO4 | BCSB30.8 |
| 2. | What is acombustion in science? | Understand | CO4 | BCSB30.8 |
| 3. | Define biomass combustion? | Understand | CO4 | BCSB30.9 |
| 4. | What are the stages of biomass combustion? | Remember | CO4 | BCSB30.9 |
| 5. | What are the types of biomass combustors? | Remember | CO4 | BCSB30.8 |
| 6. | What are the pros and cons of biomass fuels? | Understand | CO4 | BCSB30.8 |
| 7. | How does biomass produce Energy? | Remember | CO4 | BCSB30.8 |
| 8. | What are the different types of improved chullahs? | Understand | CO4 | BCSB30.9 |
| 9. | Is biomass bad for the environment? | Analyze | CO4 | BCSB30.8 |
| 10. | Define combustion and explain about Fixed bed combustors? | Understand | CO4 | BCSB30.9 |
| 11. | What are inclined grate combustors? | Understand | CO4 | BCSB30.9 |
| 12. | What are Fluidized bed combustors? | Understand | CO4 | BCSB30.9 |
| 13. | How does the energy of biomass compare to coal? | Analyze | CO4 | BCSB30.8 |
| 14. | What are the different types of biomass combustors? | Remember | CO4 | BCSB30.9 |
| 15. | What is the efficiency of Improved Chullahs program? | Remember | CO4 | BCSB30.9 |
| **PART – B (LONG ANSWER QUESTIONS)** | | | | |
| 1. | Define biomass and explain about how to produce Energy from biomass? | Remember | CO4 | BCSB30.8 |
| 2. | Explain briefly about the Non-conventional or renewable energysources.. | Understand | CO4 | BCSB30.8 |
| 3. | What is National Improved Chullahs Program? | Understand | CO4 | BCSB30.8 |
| 4. | Explain the working process of biomass boilers ? | Understand | CO4 | BCSB30.8 |
| 5. | Which biomass combustion system should I choose? | Remember | CO4 | BCSB30.8 |

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| 6. | Why should I choose Mawera for a biomass wood combustion system? | Remember | CO4 | BCSB30.8 |
| 7. | Who invented the National Improved Chullahs program and briefly explain about it'sadvantages ? | Understand | CO4 | BCSB30.8 |
| 8. | Explain about the design and working process of Fixed bed combustors. | Remember | CO4 | BCSB30.9 |
| 9. | Define combustor and Explain briefly about the types of Fixed bed combustors. | Analyze | CO4 | BCSB30.9 |
| 10. | What is biomass energy and what are the drawbacks of using it? | Remember | CO4 | BCSB30.8 |
| 11. | Explain about the design and working process of inclined grate combustors. | Remember | CO4 | BCSB30.9 |
| 12. | Explain the working of Fluidized bed combustors. | Analyze | CO4 | BCSB30.9 |
| 13. | Explain briefly about the designs of improved chullahs program. | Remember | CO4 | BCSB30.9 |
| 14. | Explain about the construction and operation of Fluidized bed combustors. | Remember | CO4 | BCSB30.9 |
| 15. | What is Biomass stoves and what are the advantages of Biomass stoves? | Understand | CO4 | BCSB30.9 |
| | **UNIT – V**<br>**BIOGAS** | | | |
| **PART – A (SHORT ANSWER QUESTIONS)** | | | | |
| **S. No** | **QUESTIONS** | **Blooms Taxonomy Level** | **Course Outcome** | **Course Learning outcome** |
| 1. | What are sustainable and eco-friendly approaches to converting the biodegradable fraction of municipal solid waste (MSW) into bioenergy? | Understand | CO5 | BCSB30.10 |
| 2. | What Is the difference between Biofuel and Biogas? | Understand | CO5 | BCSB30.10 |
| 3. | What are the uses of biogas? | Analyze | CO5 | BCSB30.10 |
| 4. | How does a Biogas digester Work? | Remember | CO5 | BCSB30.10 |
| 5. | Define biogas and explain about the properties of biogas? | Understand | CO5 | BCSB30.10 |
| 6. | What is the Calorific value and composition of biogas? | Understand | CO5 | BCSB30.11 |
| 7. | What is bioenergy system? | Understand | CO5 | BCSB30.11 |
| 8. | What are the different biomass resources? | Understand | CO5 | BCSB30.11 |
| 9. | Howis biogas made and explain what are the different types of gases used to produce it? | Analyze | CO5 | BCSB30.12 |
| 10. | What is biogas plant? | Analyze | CO5 | BCSB30.12 |
| 11. | What role can biogas play in supplying our energy needs? | Understand | CO5 | BCSB30.12 |
| 12. | What is biochemical conversion? | Understand | CO5 | BCSB30.11 |
| 13. | What is anaerobic digestion? | Understand | CO5 | BCSB30.13 |
| 14. | What are the types of biogas plants? | Understand | CO5 | BCSB30.13 |
| 15. | What is thermo chemical conversion? | Understand | CO5 | BCSB30.13 |
| **PART – B (LONG ANSWER QUESTIONS)** | | | | |
| 1. | Define biomass and Explain briefly about the resources of biomass. | Remember | CO5 | BCSB30.10 |
| 2. | What is Bio energy system and explain the Design and constructional features. | Understand | CO5 | BCSB30.11 |
| 3. | What are the classifications of Biomass resources? | Understand | CO5 | BCSB30.11 |
| 4. | Explain the biomass conversion process and list out the different types of conversions of biomass. | Remember | CO5 | BCSB30.10 |
| 5. | Define biogas plant and explain the working principle of the biogas plant? | Remember | CO5 | BCSB30.11 |
| 6. | Explain the process of Thermo chemical conversion. | Remember | CO5 | BCSB30.12 |
| 7. | Define biogas. Explain different gases constitute the biogas? | Remember | CO5 | BCSB30.12 |
| 8. | Explain briefly about anaerobic degradation process. | Understand | CO5 | BCSB30.12 |

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| 9. | Distinguish between biomass gasification, pyrolysis and liquefaction? | Remember | CO5 | BCSB30.11 |
| 10. | What is biogas plant and explain it's types and applications? | Remember | CO5 | BCSB30.12 |
| 11 | Explain the process of Alcohol production from biomass. | Remember | CO5 | BCSB30.13 |
| 12 | Explain the working process of conversion from Urban waste to energy. | Remember | CO5 | BCSB30.13 |
| 13 | Explain briefly about the Biomass energy program in India. | Remember | CO5 | BCSB30.13 |
| 14 | Explain the process of Bio diesel production. | Remember | CO5 | BCSB30.13 |
| 15 | Explain briefly about the process of direct combustion method. | Understand | CO5 | BCSB30.12 |

**Prepared by:**
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