

Scheme & Syllabi
for
Diploma in Solid & Hazardous Waste Management

One Year Programme

(W.e.f-2023-2024)

(Through Distance Education)



**Directorate of Distance Education,
Guru Jambheshwar University of Science & Technology,
Hisar-125001(Haryana)**

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Guru Jambheshwar University of Science & Technology
Hisar -125001

Name of Course	Diploma In Solid & Hazardous Waste Management (w.e.f. 2023-24)
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Semester-I

S.N.	Course No.	Title	External Marks	Internal Marks	Total	Credits
1.	SHWM-101	Solid Waste	70	30	100	4
2.	SHWM-102	Solid Waste Treatment & Disposal	70	30	100	4
3.	SHWM-103	Swachh Bharat Mission	70	30	100	4
4.	SHWM-104	Summer Training*	70	30	100	4

Semester-II

S.N.	Course No.	Title	External Marks	Internal Marks	Total	Credits
1.	SHWM-201	Hazardous Waste	70	30	100	4
2.	SHWM-202	Biomedical Waste	70	30	100	4
3.	SHWM-203	E-Waste	70	30	100	4
4.	SHWM-204	Plastic Waste	70	30	100	4

***Summer training (4-5 weeks) to be undertaken at the end of Ist semester**

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SHWM-101 Solid Waste

Maximum Marks: 100

External Marks: 70

Internal Marks: 30

Time: 3 Hours

Note:

Nine questions will be set by the examiners, two from each unit & one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit & the compulsory question. Each question will be of 14 marks.

Unit-1

Classification & Characterization: Classification of Solid Waste: Based on Type & Sources, Segregation, Categorization & Composition of Waste, Factors Influencing Waste Generation, Waste Characteristics: Physical & Chemical, Public Health & Environmental Effects.

Unit-2

Waste Collection, Transportation & Storage: Waste Collection: Types of Collection Systems, Collection Services & Equipments, Frequency of Collection, Waste Storage: Waste Storage Methods, Storage Capacity, Storage Containers, Record Keeping: Control, Inventory & Monitoring, Waste Transfer: Transfer Mean & Methods, Transfer Station.

Unit-3

Waste Processing & Minimization: Volume Reduction: Compaction, Shredding, Separation, Bailing Etc., Waste Processing: Pulverization, Gasification, Pyrolysis & Incineration, Composting (Aerobic & Anaerobic), Waste Minimization: 3R'S, 4R'S, 5R'S, Techniques of Waste Management, Metal Recovery, Utilization of Fly Ash.

Unit-4

Solid Waste Management Rules: Overview of Waste Management Legislations: The Solid Waste Management Rules, 2016, The Construction & Demolition Waste Management Rules, 2016.

Suggested Reference Books:

1. Management of Municipal Solid waste-T.V. Ramachandra
2. Solid waste Engineering- P. Aarne Vesilind, William A. Worrell, Debra R. Reinhart
3. Solid Waste Management Manual CPCB, New Delhi
4. Ecotechnology for Pollution Control & Environmental Management by Trivedy R.K. & Arvind Kumar
5. Basic Environmental Technology Nathanson, J.A.

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SHWM-102 Solid Waste Treatment & Disposal

Maximum Marks: 100

External Marks: 70

Internal Marks: 30

Time: 3 Hours

Note:

Nine questions will be set by the examiners, two from each unit & one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit & the compulsory question. Each question will be of 14 marks.

Unit-1

Biological Transformation: Composting & Vermi-Composting: Definition, Processes & Technologies, Benefits of Composts, Biogas Plant Operation & Process, Application of Biogas, Biogas Plants in India.

Unit-2

Chemical Transformation: Incineration: Types of Incinerators, Factor Affecting Incineration, Methods of Incineration (Mass Burning System, Refused Derived Fuel), Air Emission & Control, Pyrolysis: Types of Pyrolysis Processes, Factors Affecting Pyrolysis, Advantages & Limitation, Gasification: Types, Processes, Advantages & Limitations.

Unit-3

Material & Energy Recovery: Role of Circular Economy in context of Solid Waste Management, Material Recovery: Hand Picking, Screens, Float, Sink Separators, Magnetic Separators & Material Recovery Plants, Energy Recovery: Heat Value of Waste, Waste to Energy, Mass Burn System & RDF: Plant Design, Process Design, Efficiency, Residue Handling

Unit-4

Landfill: Site Selection, Landfilling Methods, Design and Operation of Landfills, Occurrence and Movement of Gases and Leachate in Landfills, Leachate Contamination & Treatment, Land Farming and Deep Well Injection

Suggested Reference Books:

1. Solid Waste Management by Sasikumar K.
2. Elements of Solid Hazardous Waste & Management by O. P. Gupta
3. Solid & Liquid Waste Management: Waste to Wealth by Rajaram Vasudevan
4. Solid Waste Management: Present & Future Challenges by AL. Ramanathan Jagbir Singh
5. Textbook of Solid Wastes Management by KHAN LH

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SHWM- 103 Swachh Bharat Mission

Maximum Marks: 100
External Marks: 70
Internal Marks: 30
Time: 3 Hours

Note:

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Unit-1

Introduction: Terminology, Gandhian Philosophy of Cleanliness, Swachh Bharat Abhiyan (SBA), Hygiene, Sanitation & Sustainable Waste Management, Different Phases of the SBA & Its Evaluation, Citizens' Responsibilities: Role of Swachhagrahi, Swachata Pledge, Symbols, SBM guidelines.

UNIT-2

Swachh Bharat: Indicators for Swachh Bharat, Rural-Sanitation Coverage Across Households (2014 vs. 2022), Open Defecation Free (ODF) Villages Parameters, ODF Plus Model, Key Indicators, Urban-Sustainable Sanitation, Garbage Free Cities, Garbage Free Star Rating (Cities).

UNIT-3

Prospects & Challenges: Attitudes & Perceptions, Operational & Financial Issues, Monitoring & Supervision, Community Mobilization, Ranking of Cities, Swachh Tourist Destinations.

UNIT-4

Events Details Related to SBA: Case Studies, Schemes & Programs of Government Swachh Bharat Abhiyaan. Case Studies: Success Stories on Swachh Bharat Abhiyaan Mission in Indian States.

Suggested Reference Books:

1. Swachh Bharat Abhiyan by Dr. Saurabh Mishra

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SHWM-201 Hazardous Waste

Maximum Marks: 100

External Marks: 70

Internal Marks: 30

Time: 3 Hours

Note:

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Unit-1

Introduction: Definition, Sources, Characterization, Classification, Symbols of Hazardous Waste, Types of Hazardous Waste (Corrosive, Reactive, Toxic, Flammable Waste), Impact on Human Health & Environment

Unit-2

Storage & Transportation of Hazardous Waste: Compatibility of Waste, Storage of Hazardous Waste: Guidelines, Containers, Surface Impoundment, Land Filling, Underground Injection, Transportation: Waste Accumulation & Transportation Guidelines/Regulation, Manifest System, Record Keeping & Reporting, Hazardous Waste Packing: Labeling, Marking & Placarding, Modes of Transportation of Hazardous Waste

Unit-3

Hazardous Waste Treatment: Filtration & Separation, Chemical Precipitation, Chemical Oxidation, Solidification & Stabilization, Evaporation, Ozonation, Thermal Treatment: Incineration, Pyrolysis, Biological Treatment Aerobic & Anaerobic Treatment, Bioremediation, Bio-reclamation, Deep Well Injection

Unit-4

Hazardous Waste Management Rules: Hazardous Waste (Management & Transboundary Movement) Rules, 2016

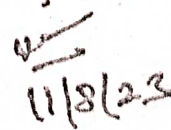
Suggested Reference Books:

1. Handbook on chemicals & hazardous waste management & handling in India by MOEFCC.
2. Hazardous Waste Management, Volume II, Characterization & treatment process by Sukalyan Sen gupta.
3. Solid & Hazardous Waste Management by S. C. Bhatia.
4. Solid & Hazardous Waste Management, Second Edition by M. N. Rao.
5. Environmental Law 7/e, 2022 by S.C. Shastri.

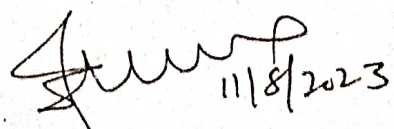


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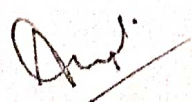

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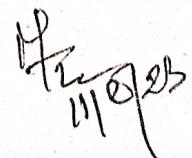

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SHWM-202 Biomedical Waste

Maximum Marks: 100

External Marks: 70

Internal Marks: 30

Time: 3 Hours

Note:

Nine questions will be set by the examiners, two from each unit & one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit & the compulsory question. Each question will be of 14 marks.

Unit-1

Introduction: Sources & Classification of Biomedical Waste, Causes of Biomedical Waste Production, Health Hazards of Biomedical Waste.

Unit-2

Biomedical Waste Collection, Transportation & Storage: Waste Collection, Segregation & Labeling, Waste Handling, Onsite/Offsite Transportation, Protocol for Transportation of Waste, Spill Management, Patient Safety for Infection, Control & Prevention.

Unit-3

Treatment of Biomedical Waste: Needs of Disposal of Biomedical Waste, Standards Operating Procedure & Protocols for Biomedical Waste Treatment: Wet Treatment Technology, Incineration, Microwave, Autoclave, Electrothermal Activation, Waste Disposal Methods: Deep Burial Pit, Sharp Disposal Pit, Secure Landfill.

Unit-4

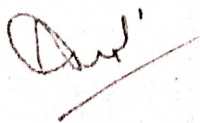
Biomedical Waste Management Rules: The Bio-Medical Waste Management Rules, 2016 & Amendments, National Guidelines for Hospital Waste Management, Monitoring Performance for Hospital Waste Management.

Suggested Reference Books:

1. Biomedical Waste: Management, Recycling, & Applications by Himadri Panda.
2. Environmental law 7/e, 2022 by S.C. Shastri.


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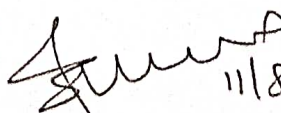
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SHWM-203 E-Waste

Maximum Marks: 100
External Marks: 70
Internal Marks: 30
Time: 3 Hours

Note:

Nine questions will be set by the examiners, two from each unit & one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit & the compulsory question. Each question will be of 14 marks.

Unit-1

Introduction: Sources, Characteristics, Generation of E-Waste, Health Hazards of E-Waste, Growth of Electrical & Electronics Industry in India, Indian & Global Scenario of E-Waste

Unit-2

Collection, Storage & Transportation of E-Waste: Methods of E-Waste Collection, Safety Protocols for Handling of E-Waste, Onsite/Offsite Storage & Transportation of E-Waste

Unit-3

Treatment & Disposal of E-Waste: Sorting, Crushing, Separation & Purification of E-Waste, Recycling & Recovery of Materials from E-Waste, Methods of E-Waste Disposal: Landfilling, Incineration etc.

Unit-4

E-Waste Management Rules: E-Waste Management Rules 2016, The Batteries (Management & Handling Rules) 2001

Suggested Reference Books:

1. E-waste: Regulations, Management Strategies & Current Issues by Zeng, Xianlai.
2. E-waste: Management, Types & Challenges by Li, Yuan Chun.
3. E-Waste Management: Challenges & Opportunities in India by Varsha Bhagat-Ganguly.
4. E-waste: implications, regulations, & management in India & current global best practices by Rakesh Johri.
5. Environmental Law 7/e, 2022 by S.C. Shastri.

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SHWM-204 Plastic Waste

Maximum Marks: 100

External Marks: 70

Internal Marks: 30

Time: 3 Hours

Note:

Nine questions will be set by the examiners, two from each unit & one question of short answer/objective type covering the whole syllabus, which will be compulsory. Students will have to attempt five questions in all, including one question from each unit & the compulsory question. Each question will be of 14 marks.

Unit-1

Introduction: Plastic Waste, Types: Thermoplastic & Thermosetting, Sources & Color Coding, Uses, Present & Future Trends of Plastic in India & Globally

Unit-2

Impact of Plastic: Nuisance Plastic, Impact of Plastic on Marine Life, Wildlife, Human Health & Environment, Economic Impacts on Plastic Ban

Unit-3

Plastic Waste Management: Waste Disposal Methods: Plastic Recovery, Recycling of Plastic Waste, 4R'S, (Reduction, Reuse, Recycle, Recovery), Plastic in Landfill, Recycling Methods of PVC, PET, PMMA, HDPE, LDPE, PS, Uses of Plastic in Roads, Issues/Challenges, Possible Alternative Materials of Plastic

Unit-4

Plastic Waste Management Rules: Central Pollution Control Board Guidelines for Plastic Waste, Plastic Waste Management Rules, 2016 & Amendments

Suggested Reference Books:

1. Plastics Waste Management, Muralisrinivasan Natamai Subramanian, 9781119555872, 2019 Scrivener Publishing.
2. SWACHH BHARAT MISSION, Municipal Solid Waste Management Manual, Central Public Health & Environmental Engineering Organization (CPHEEO) 2016.

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