

# **FACULTY OF SCIENCES**

## **SYLLABUS FOR THE BATCH 2024-25**

**Programme Code: ZVCT**

**Programme Name: Certificate/Diploma in Vermicompost Technology  
(Semester I-II)**

**Examinations: 2024-2025**



**Department of Zoology  
Khalsa College, Amritsar**

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(b) Subject to change in the syllabi at any time.  
(c) Please visit the College website time to time.**

S. No.	PROGRAMME OBJECTIVES
1.	To study Minimization, collection, disposal and treatment of solid waste management.
2.	Understand concepts of Recycling and create public awareness about solid wastes.
3.	Study organic waste management, resource recovery, and waste reductions in vermicomposting.
4.	Study soil improvement and promote concepts of sustainability in context of vermicomposting.
5.	Understand anatomy and physiology of earthworms.
6.	Study species and ecological role of earthworms in vermicomposting.

S.No.	PROGRAMME SPECIFIC OUTCOMES (PSOS)
PSO-1	Have knowledge of waste diversion, resource recovery, economic benefits, and environmental conservation.
PSO-2	Will be able to understand the biology of earthworms in maintaining soil biodiversity and ecosystem stability.
PSO-3	Promotion of recycling, contributing to resource conservation.
PSO-4	Provide knowledge about economic opportunities as a vermicompost farmer.
PSO-5	The knowledge of Lifecycle of earthworms and their role in vermicomposting.

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**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

<b>COURSE SCHEME</b>											
<b>SEMESTER - I</b>											
<b>Course Code</b>	<b>Course Name</b>	<b>Hours /Week</b>	<b>Credits</b>			<b>Total Credits</b>	<b>Max Marks</b>				<b>Page No.</b>
			<b>L</b>	<b>T</b>	<b>P</b>		<b>Th</b>	<b>P</b>	<b>IA</b>	<b>Total</b>	
ZVCT111	Solid Waste Management - I	4	3	1	-	4	75	--	25	100	4
ZVCT112	Vermicompost technology-I	4	3	1	-	4	75	--	25	100	6
ZVCT113	SWM-I Practical	4	-	-	4	2	--	37	13	50	8
ZVCT114	VCT-I Practical	4	-	-	4	2	--	37	13	50	9
										300	

<b>SEMESTER – II</b>											
<b>Course Code</b>	<b>Course Name</b>	<b>Hours /Week</b>	<b>Credits</b>			<b>Total Credits</b>	<b>Max Marks</b>				<b>Page No.</b>
			<b>L</b>	<b>T</b>	<b>P</b>		<b>Th</b>	<b>P</b>	<b>IA</b>	<b>Total</b>	
ZVCT121	Solid Waste Management-II	4	3	1	-	4	75	--	25	100	10
ZVCT122	Vermicompost technology-II	4	3	1	-	4	75	--	25	100	12
ZVCT123	SWM-II Practical	4	-	-	4	2	--	37	13	50	14
ZVCT124	VCT-II Practical	4	-	-	4	2	--	37	13	50	15
										300	

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**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

**Semester-I**

**Theory**

**COURSE CODE: ZVCT111**

**COURSE TITLE: SOLID WASTE MANAGEMENT-I**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 75**

**Internal Assessment: 25**

**Total Marks: 100**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

1. **Section A:** Question 1 will be compulsory (15 marks). There will be of 10 short answer type questions (1.5 marks each).
2. **Section B:** Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 15 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to

1.	Demonstrate the disposal of solid waste.
2.	Understand the management of solid waste.
3.	Understand recycling of solid waste.

**Unit- I**

**Solid wastes**

- Introduction to solid waste
- Classification & composition of solid wastes
- Types and sources of solid waste

**Unit- II**

**Solid waste types**

- Special wastes: Types, hazardous wastes, Biomedical waste, domestic waste; Sewage sludge and municipal waste; Slaughter house waste; Agricultural waste; Mining waste; Radioactive waste

**Unit-III**

**Solid waste management**

- Integrated Solid waste Management
- Solid waste characterization: ultimate and proximate analysis; Waste reduction at source, volume reduction and collection techniques.
- Recycling of solid wastes

**Unit-IV**

**Treatment and disposal techniques**

- Burning
- Landfill: Landfilling methods and operation, Landfill liners: clay

**Suggested Readings:**

1. Evans, G. *Biowaste and Biological Waste Treatment*. UK: James and James, Science Publishers Ltd., 2005.
2. Hammer, M.J. and Hammer Jr M.J. *Water and Wastewater Technology*. 3rd ed. Delhi:Prentice Hall of India, 2000.
3. Jaswal, P.S. and Jaswal N. *Environmental Law*. Delhi: Pioneer Publications, 2003.
4. Kreith, F. *Handbook of Solid Waste Management*. USA: McGraw Hill Publishers, 1999.
5. Kumar, R. and Singh R.N. *Municipal Water and Wastewater Treatment*. New Delhi: CapitolPub Co., 2006.
6. Misra, S.P and Pandey, S.N. *Essential Environmental Studies*. Ane Books PVT. Ltd.
7. Noble, G. *Sanitary Landfill Design Handbook*. USA: Technomic Westport Connecticut,1976.
8. Santra, S.C. *Environmental Science*. New central book agency (p) Ltd, London. 2014.
9. Peavey, H.S., Rowe, D.R. and Tchobanoglous, G. *Environmental Engineering*. New York:McGraw-Hill, 1985.
10. Shah, K.L. *Basics of Solid and Hazardous Waste Management Technology*. USA: McGrawHill, 1999.
11. Tchobanogloas, G. *Integrated Solid Waste Management: Engineering, Principle and Management*. USA: McGraw Hill, 1993.
12. White, P, Frank, M, and Hindle P. *Integrated Solid Waste Management- A Life Cycle Inventory*. USA: Chapman & Hall, 1999.

**Course Outcomes**

CO-1.	Students get to know about the types of solid waste.
CO-2.	Students get to know about the management of solid waste.
CO-3.	Students get to know about the recycling of solid waste.

**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

**Semester-I**

**Theory**

**COURSE CODE: ZVCT112**

**COURSE TITLE: VERMICOMPOST TECHNOLOGY-I**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 75**

**Internal Assessment: 25**

**Total Marks: 100**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

1. **Section A:** Question 1 will be compulsory (15 marks). There will be of 10 short answer type questions (1.5 marks each).
2. **Section B:** Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 15 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to

1.	Study morphology and anatomy of earthworms.
2.	Study the taxonomic keys for earthworm.
3.	Study vermicomposting and vermiculture.
4.	Study of the procedure of vermicomposting

**UNIT-I**

**Earthworm Discription:**

- Earthworm morphology
- Brief introduction of Earthworm Anatomy
- Earthworm identification characters
- Taxonomic keys for earthworm species

**UNIT-II**

**Earthworm Classification and Types of earthworms:**

- Earthworm classification
- Characteristics of Indian Earthworm families

**UNIT-III**

**Vermicomposting and vermiculture**

- Difference between Vermiculture and Vermicomposting
- Earthworms species used in vermicomposting
- Life cycle and brief description of *Eisenia fetida*

**UNIT-IV**

**Vermicomposting procedure**

- Small Scale and Large scale; Procedure of harvesting
- Factors affecting vermicomposting

**Suggested Readings:**

1. Dhama, P.S., Invertebrate Zoology: Pardeep Publisher
2. Edwards, C.A and J.R. Lofty. Biology of Earthworm. Chapman and Hall. London
3. Kotpal, R.L., Invertebrate Zoology: Rastogi Publisher
4. Tewatia G. Earthworm Ecology. Discovery Publishing House, New Delhi.

**COURSE OUTCOMES:**

CO-1.	The students will get to know about morphology and anatomy of earthworm.
CO-2.	The students will get to know about the taxonomic keys for earthworm.
CO-3.	The students will get to know about the procedure of vermicomposting.

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**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

**Semester-I**

**COURSE CODE: ZVCT113**

**COURSE TITLE: SWM-I PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Demonstrate the disposal of solid waste.
2.	Understand the management of solid waste.

**Practical List**

1. To study proper disposal of solid waste.
2. To study the management of solid waste and its types.
3. To study integrated Solid waste management.
4. To study types of recycling and landfilling methods.
5. To study various treatments and Disposal techniques of solid waste.

**Note: - Some changes can be made in the practical depending on the availability of material**

**COURSE OUTCOMES**

CO-1.	Students get to know about the disposal of solid waste.
CO-2.	Understand the management of solid waste.
CO-3.	Learn Treatment and Disposal technique of solid waste



**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

**Semester-I**

**COURSE CODE: ZVCT114**

**COURSE TITLE: VCT-I PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Identify the species of earthworms used.
2.	Compare and contrast the characteristics of various earthworms used.
3.	Understand the procedure of vermicomposting.

**Practical List**

1. Key to identify different types of earthworms.
2. Study of external features of earthworm species.
3. Study of life stages & development of *Eisenia fetida*.
4. Collection of native earthworms & their identification.
5. Study of Vermiculture, Vermiwash & Vermicompost equipments, devices.
6. Preparation of vermibeds, maintenance of vermicompost & climatic conditions.

**Note: - Some changes can be made in the practical depending on the availability of material**

**COURSE OUTCOMES:**

CO-1.	They will get the knowledge of biodiversity of local earthworms.
CO-2.	Students will get technical knowhow regarding the preparation of vermicompost.

**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

**Semester-II**

**Theory**

**COURSE CODE: ZVCT121**

**COURSE TITLE: SOLID WASTE MANAGEMENT-II**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 75**

**Internal Assessment: 25**

**Total Marks: 100**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

- Section A:** Question 1 will be compulsory (15 marks). There will be of 10 short answer type questions (1.5 marks each).
- Section B:** Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 15 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to

1.	Understand various waste treatment methods.
2.	Understand the merits and demerits of waste disposal methods.
3.	Study the rules of municipal waste management.

**UNIT-I**

**Waste treatment methods**

- Composting
- Incineration
- Pyrolysis
- Gasification

**UNIT-II**

**Waste disposal methods**

- Merits and demerits of waste disposal methods
- Biogas: Method and applications

**UNIT-III**

**Municipal waste management and rules**

- Municipal Waste (Management and Handling) Rules 2000
- Recycled Plastics (Manufacture and usage) Rules
- Role of GIS in Waste Management.

**UNIT-IV**

**Hospital waste management and rules**

- Hospital Waste Management
- Hazardous Waste Management & Handling rules, 1998 & 2000 (amendments).
- Waste management policies in India.

**Suggested Readings:**

1. Evans, G. *Biowaste and Biological Waste Treatment*. UK: James and James, Science Publishers Ltd., 2005.
2. Hammer, M.J. and Hammer Jr M.J. *Water and Wastewater Technology*. 3rd ed. Delhi: Prentice Hall of India, 2000.
3. Jaswal, P.S. and Jaswal N. *Environmental Law*. Delhi: Pioneer Publications, 2003.
4. Kreith, F. *Handbook of Solid Waste Management*. USA: McGraw Hill Publishers, 1999.
5. Kumar, R. and Singh R.N. *Municipal Water and Wastewater Treatment*. New Delhi: Capitol Pub Co., 2006.
6. Misra, S.P and Pandey, S.N. *Essential Environmental Studies*. Ane Books PVT. Ltd.
7. Noble, G. *Sanitary Landfill Design Handbook*. USA: Technomic Westport Connecticut, 1976.
8. Santra, S.C. *Environmental Science*. New central book agency (p) Ltd, London. 2014.
9. Peavey, H.S., Rowe, D.R. and Tchobanoglous, G. *Environmental Engineering*. New York: McGraw-Hill, 1985.
10. Shah, K.L. *Basics of Solid and Hazardous Waste Management Technology*. USA: McGraw Hill, 1999.
11. Tchobanogloas, G. *Integrated Solid Waste Management: Engineering, Principle and Management*. USA: McGraw Hill, 1993.
12. White, P, Frank, M, and Hindle P. *Integrated Solid Waste Management- A Life Cycle Inventory*. USA: Chapman & Hall, 1999.

**COURSE OUTCOMES:**

CO-1.	Study of various waste treatment methods.
CO-2.	Learn about the merits and demerits of waste disposal methods.
CO-3.	Know about the rules of municipal waste management

**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**

**Semester-II**

**Theory**

**COURSE CODE: ZVCT122**

**COURSE TITLE: VERMICOMPOST TECHNOLOGY-II**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Theory Paper: 75**

**Internal Assessment: 25**

**Total Marks: 100**

**Periods/week: 6**

**Time: 3 Hrs.**

**Instructions for the Paper Setters:**

1. **Section A:** Question 1 will be compulsory (15 marks). There will be of 10 short answer type questions (1.5 marks each).
2. **Section B:** Candidates shall be required to attempt 4 questions, one from each unit. Each question carries 15 marks. Preferably, the question should not be split into any sub-parts. In case of any splitting, it should not have more than two sub-parts.

**COURSE OBJECTIVES:** The paper aims to-

1.	Understand vermicomposting and vermiculture.
2.	Understand the procedure of vermicomposting.
3.	Understand various physico-chemical parameters of vermicompost.
4.	Understand application of vermicomposting.

**UNIT-I**

**Factors affecting earthworm diversity:**

- Factors influencing earthworm diversity (pH, Temperature, Moisture, Light, Types of food, Soil texture, aeration etc.)
- Enemies of Earthworms

**UNIT-II**

**Earthworm collection, preservation and their role:**

- Earthworm collection methods
- Earthworm Preservation
- Diverse roles of earthworms in ecosystems

**Unit-III**

**Physico-Chemical analysis of vermicompost**

- Instrumental Techniques for analysis of vermicompost
- Procedure for Physico-Chemical analysis of vermicompost
- Physico-Chemical analysis of Compost, Organic manure and vermicompost (As per FCO standards)

**UNIT-IV**

**Application of vermicomposting/ vermitechology**

- Benefits of earthworm and vermicompost
- Use of earthworm in medicine
- Employment opportunities in vermicomposting

**Suggested Readings:**

1. Dhami, P.S., Invertebrate Zoology: Pardeep Publisher
2. Edwards, C.A and J.R. Lofty. Biology of Earthworm. Chapman and Hall. London
3. Kotpal, R.L., Invertebrate Zoology: Rastogi Publisher
4. Tewatia G. Earthworm Ecology. Discovery Publishing House, New Delhi.

**COURSE OUTCOMES:**

CO-1.	Knowledge related to the vermicomposting and vermiculture.
CO-2.	Have practical skills of vermicomposting.
CO-3.	Apply knowledge of vermicomposting to day to day life.
CO-4.	Understand various physico-chemical parameters of vermicompost

**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**  
**Semester-II**

**COURSE CODE: ZVCT123**  
**COURSE TITLE: SWM-II PRACTICAL**

**Credit Hours: 4 hrs.**

**Total Hours: 60 hrs.**

**Practical Paper: 37**

**Internal Assessment: 13**

**Total Marks: 50**

**Periods/week: 6**

**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Study various waste treatment methods.
2.	Study the rules of municipal waste management.

**Practical List**

1. To study various waste treatment methods.
2. Study of various Instruments/techniques used in solid waste management.
3. Various methods for Recycling of plastics.
4. Project report

**Note: - Some changes can be made in the practical depending on the availability of material**

**COURSE OUTCOMES:**

CO-1.	Students will be able to study various waste treatment methods.
CO-2.	Students will be able to study the rules of municipal waste management.

**CERTIFICATE/DIPLOMA IN VERMICOMPOST TECHNOLOGY**  
**Semester-II**

**COURSE CODE: ZVCT124**  
**COURSE TITLE: VCT-II PRACTICAL**

**Credit Hours: 4 hrs.**  
**Total Hours: 60 hrs.**  
**Practical Paper: 37**  
**Internal Assessment: 13**  
**Total Marks: 50**

**Periods/week: 6**  
**Time: 3 Hrs.**

**Important Note for Practical:**

- A. Candidates will be required to submit their original note books containing record of their laboratory work.
- B. As per the latest UGC guidelines the dissections may please be avoided. In no case an animal falling under the categories of wildlife protection act 1972 should be caught or dissected. The rules of the Prevention of cruelty to Animals act 1960 should be familiar to all who are teaching the zoology courses. The guidelines on this issue are also available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)

**COURSE OBJECTIVES:** The paper aims to

1.	Understand the procedure of vermicomposting.
2.	Understand physico-chemical analysis of vermicompost.

**Practical List**

1. Study of various methods for the collection of earthworms.
2. Study of preservation methods of earthworms
3. Study of physico-chemical analysis of vermicompost.
4. Study of various enemies of earthworm.
5. Study of various equipments/materials used in vermicomposting.

**Note: - Some changes can be made in the practical depending on the availability of material**

**COURSE OUTCOMES**

CO-1.	Students will get technical knowhow regarding the preparation of vermicompost.
CO-2.	Students will be able to prepare vermicompost and organic manure.
CO-3.	Students will also perform physico-chemical examination of vermicompost.