Enclosure-IV

Syllabi & evaluation norms for Part-III courses

OFFERING DEPARTMENT: DEPARTMENT OF INDUSTRIAL CHEMISTRY
SEC II – CO-CURRICULAR COURSE
ANY SEMESTER BETWEEN II to V

16UICCOC1	**TREATMENT OF ENVIRONMETAL WASTE**	**80 HRS**	**01 CREDIT**

OBJECTIVE:

1. Gain insight into the design and recycling of municipal solid waste.
2. To expose the student to various treatments for recycling of gas and wastewater for reuse and disposal.
3. Understand the design and operation of Plastic waste-to-energy facility.
4. To develop a basic knowledge about the E-waste recycling process.

UNIT-I Municipal Solid Waste Treatment **20 HRS**

- Definition of solid waste,
- waste generation,
- sources and types of solid waste
- sampling and characterization,
- Determination of composition of MSW, storage and handling of solid waste.
- Unit operations for separation and processing, Materials Recovery facilities,
- Waste transformation through combustion and aerobic composting, anaerobic methods for materials recovery and treatment.
- Energy recovery – Incinerators

UNIT-II Waste Water Treatment **20 HRS**

- Sources and types of waste water.
- Physical, chemical and biological treatment of waste water:
- Primary treatment- sedimentation, primary clarifier, final clarifier, flocculation.
- Secondary treatment- Trickling filter, activated sludge process, biological tower, combined filtration and aeration process.
- Tertiary treatment - Chemical precipitation, Membrane filtration, Reverse osmosis, Ion exchange, Electro-dialysis and Effluent disinfections,
- Design aspects of effluent treatment plant (ETP),
- Concept, operation and maintenance of common effluent treatment plant (CETP).
- Reuse of treated water in industries, agriculture, oil refineries, thermal power stations and domestic uses.

UNIT-III Gas Treatment **10 HRS**

- Various sources of waste gases,
- Recovery of important gases CO_2, SO_2, NO etc.
- Recycling process: Electrostatic precipitation, bag filters, wet/dry grid arrestors.
- Absorption in liquids by Scrubbers, adsorption on solids.
- Combustion: flaring, thermal incineration, catalytic oxidation

UNIT-IV Electronic Waste (E-Waste) Treatment **10 HRS**

- Sources of generation, categories, segregation, constituents of E-wastes,
- Collection and transport, recycling of e-waste and its environmental consequences,
- E-Waste (Handling and Management) Rules 2011.

UNIT-V Plastic Waste Treatment **20 HRS**

- Introduction to Plastic Waste,
- Sources, Separation processes: Primary recycling, secondary recycling, and tertiary recycling.
- Use of waste plastic as filler,
- Recycling of Various Plastics: HDPE, Acrylics, PET, PVC, Engg. Plastics, Medical Plastics.

TEXT BOOKS:

1. Reddy, M. A. (2010), *Text book of Environmental Science and Technology*. India: BS Publications.
2. Hammer, M. J. and Hammer M. J. Jr., (2002), *Water and Wastewater Technology-IV*. India: Prentice Hall of India.
3. Leidner, J., (2004), *Plastic waste: Recovery of Economic Value.* USA: Marcel Dekker Inc.

REFERENCE BOOKS:

1. Dara, S. S., (2004). A *text book of Environmental Chemistry and Pollution Control*. India: S. Chand (G/L) & Company Ltd.
2. Rao, M. N., (1993). *Air pollution*. New York: Mcgraw Hill.
3. Kreith, F. and Tchobanoglous, G. (2002), *Handbook of Solid Waste Management*. New York: McGraw Hill Professional
4. Rao, M. N and Datta, A. K. (2012), *Wastewater Treatment.* New Delhi: IBH Publishing Company.

DEPARTMENT OF INDUSTRIAL CHEMISTRY

SEC-II (Co-Curricular Courses)

Evaluation Norms for Co-Curricular Courses

The following are the evaluation norms for the co-curricular course under the SEC category that of the students are going to opt in any semester between II and IV.

Both the theory and practical examination will be conducted to evaluate the students in the following way.

1. **Theory**
   Theory exam will be of total 100 marks and will have both Continuous Internal Evaluation (CIE) component and Course End Examination (CEE)
   i) CIE = 40 Marks
      CEE = 60 Marks
      Total = 100 Marks
   ii) Components of CIE

Sr.	Component	Content	Duration	Marks	Sub Total
a)	Test-I Test-II	-1st two units -All 5 units	2 hrs 2 hrs	10 (set for 50) 10 (set for 50)	20
b)	Assignment-I Assignment-II	- -	- -	10 10	20
				Grand Total	40 Marks

2. **Practical**
   Practical exam will be of total 100 marks and will have both CIE component and Course End Examination (CEE)
   i) CIE = 40 Marks
      CEE = 60 Marks
      Total = 100 Marks
   ii) Components of CIE

Sr.	Component	Content	Duration	Marks	Sub Total
a)	Test-I Test-II	50% of experiments All experiments	3 hrs As per duration of CEE	10 (set for 30 marks) 20 (set for 60 marks)	30
b)	Observation book & record	-	-	10	10
				Grand Total	40 Marks

Guidelines for CIE of Theory & Practical

1. Only remarks will be given at the end of the course.
2. A separate certificate on completion of each course will be issued by the CoE.
3. All above are compulsory components.
4. In event of non-completion of course, the student has to re-do the course or opt for another one.

3. **At the end of the year no marks be given, only remarks be given as follows:**

Range of Marks (Theory + Practical)	**Remarks**
90-100	Excellent
75-89	Very Good
60-74	Good
40-59	Fair
39 and below	Not completed

4. **Course End Examination (CEE) – Theory, would be of 3hr duration and question paper pattern and distribution of marks will be as per the modal question paper provided below:**

SKILL ENHANCEMENT COURSE - Treatment of Environmental Waste
Course End Examination (Theory)

(Course Code): (Course Title):
[Time: 3 hours] [Total Marks: 60]

Question1. Answer the following questions (1 Mark x 10 = 10 Marks)
(Note: Questions may be of MCQ type or very short answer type. For very short answer type questions maximum word limit is 20 words)

(i) ____
(ii) ____
(iii) ____
(iv) ____
(v) ____
(vi) ____
(vii) ____
(viii) ____
(ix) ____
(x) ____

Question2. Answer any five questions out of the given seven (4 Marks x 5 = 20 Marks)
(Note: Each question carry equal marks and answer of each question should not exceed more than hundred words)

Q2(a) ____

Q2(b) ____

Q2(c) ____

Q2(d) ____

Q2(e) ____

Q2(f) ____

Q2(g) ____

Question3. Answer any five questions out of the given seven (6 marks x 5 = 30 marks) (Note: Each question carry equal marks and answer of each question should not exceed more than three hundred words)

Q3(a) ____

Q3(b) ____

Q3(c) ____

Q3(d) ____

Q3(e) ____

Q3(f) ____

Q3(g) ____