Department of Environmental Science & Engg, ISMU, Dhanbad

B.Tech (Environmental Engg)- VI Semester:: Dated 23-11-2008

Lecture plan: ESC 161 01: Municipal Wastewater Engineering [3-1-0]

Part-II (Biological treatment): S K Maiti

Sl.No	Topics	Con. Hrs
1.	*Sewage treatment process*, Introduction, reactor type, hydraulic characteristics, C-diagram, calculation of dispersion number, types of biological reactor; Aeration system, oxygen transfer, factors affecting oxygen transfer, types of aerators, removal of VOCs by aeration.	2
2.	Introduction, role of wastewater engineer; Sewage characteristics: Quantity & Quality: Physical, chemical & biological; flow rate, treatment flow -sheets.	2
3.	*Biological treatment:* Principle of biological treatment-derivation of bacterial growth kinetics used in designing of wastewater treatment plant; Operation and design aspects of ASP and its modifications; Operational problems of ASP- bulking and raising sludge; Nocardia growth Design of secondary settling tank;	6
4.	*Wastewater treatment for Small communities* - Oxidation ditch, Extended aeration system; Design & operation of SBRs;	2
5.	Process design and operation of mechanically *Aerated lagoon* and problems	2
6.	*Design & operation of Waste Stabilization Ponds* - types, oxygen production and algal washout, design based on organic loading rate and BOD kinetics, anaerobic activity, microbial activity in pond, N and Phosphorus removal.	2
7.	Aerobic attached growth process: Process design and operation of Trickling filter, RBC and Biofilter.	2
	Midterm test	
8.	Anaerobic treatment: process microbiology and biochemistry; application for treatment of sewage, advantage and disadvantages. Design & operation of UASB and hybrid bioreactors.	4
9.	*Advance wastewater treatment system*: biological removal of nitrogen and phosphorous. Design and operation of biological nitrification - denitrification system; luxurious phosphorus uptake.	2
10.	Aquatic plant system, constructed Wetlands;	1
11.	Sludge handling and disposal, design of sludge drying bed.	1
12.	Disposal, reuse and dilution of treated sewage; self-purification of streams.	1
13.	Land irrigation and sewage farming, wastewaters reuse, ground water recharge; and vermiculture,	1
14.	Standards of disposal into natural water courses and on land, Indian Standards. CETP design, operation and maintenance aspects.	2
	TOTAL	**30**

23/11/08

Books and References

1. *Wastewater Engineering: Treatment, disposal, Resuse* by Metcalf & Eddy Inc.4th ed. TMGHI, New Delhi, 2003.
2. *Environmental Engineering* by Peavy, H.S. Donald R.Rowe & G. Tchobanoglosus, MGH Int. Ed. New York, 1985.
3. *Wastewater treatment for pollution Control* by Soli J Arceivala, Tata McGraw Hill,Second edition, 1998
4. *Biological process design for wastewater treatment* by L.D.Benefield and C.W .Randall, PH, Englewood Cliff, NJ, 1980 (not available in ISM Lib)
5. *Wastewater treatment Plants: Planning, Design and Operation* by S.R..Qasim, Holt, Rinehart and Winston,NY,1985
6. *Biological Wastewater Treatment: Theory and Application* by C.P.L. Grady and H.C.Lim, Marcel Decker, NY 1980.
7. *Environmental Biotechnology* by Bruce E. Rittmann & Perry L McCarty, McGrawhill International Editions, 2001.

28/11/08

Department of Environmental Sc. & Engg.
ISM University, Dhanbad
B.Tech (Environmental Engg.) - IV Semester

LECTURE PLAN: ESC 141 01: Environmental Microbiology [3-1-0]

	Section A: S.K.Maiti	
1	Environmental importance of micro-organisms: *Protozoa & other multicellular organisms: groups*- Flagellates, Amoebae, Sporozoans & ciliates; Rotifers, Crustaceans, Worms & larvae, pathogenic protozoa. *Algae* – Classifications, reproductions (asexual and sexual- isogamy and heterogamy), Algae of Environmental significance. *Fungi* – vegetative body, classifications, environmental significance, cultivation and isolation of fungi. *Actinomycetes* – characteristics, Nocardia foam. *Viruses*- structure, bacteriophages, multiplication of a virulent phage- the lytic cycle, lysogeny, tumour formations, important human viral pathogens.	5
2	*Enumeration of microbes* Microscopy – (Bright fields, Dark fields, Phase contrast, Florescence & Electron microscopy); Staining - Simple staining, GRAM staining, Acid-fast staining; Quantitative Enumeration of microbes; Total count (Microscopic, Electronic, Turbidometric, Wet & dry weight & Chemical); Viable count- (Plate count, Membrane filter, & MPN).	3
3	*Mechanisms of killing,* Control By Physical Agents-Dry heat (100 °C), *moist heat* – autoclaving, tyndallisation, pasteurization, filtration, irradiation, desiccation, osmotic pressure, physical clearing. Chemical Methods - Sterilization & Disinfection; Phenols & phenolic compounds); Alcohols, Halogens, Heavy metals & their compounds, Dyes, Detergents, Quaternary ammonium compounds, Aldehydes, Gaseous agents (CH2-O-CH2); *Evaluation of antimicrobial agents; Conservation of food.*	4
4	Growth of bacteria, batch culture; specific growth rate and doubling time; continuous culture; synchronous growth; Effects of environmental factors on growth; Bacterial nutrition;	3
5	Drinking water microbiology; water borne pathogens, MPN test; faecal coliform and faecal streptoccoci, MF techniques, IMVIC test Aerobic and anaerobic degradation of waste; Suspended growth process: Activated sludge process (ASP) & Oxidation ditch (OD), Attached growth process: Trickling filter (TF) & Rotating Biological Contractor (RBC), Pond Microbiology: Waste stabilization pond (WSP) & Oxidation pond. Microbiology & biochemistry of anaerobic process; Nitrification & Denitrifications; Luxurious phosphorus uptake. Aeromicrobiology; Soil microbiology- biofertilizer, VAM fungi,	7
	Total	22

Referees:

1. Microbiology- by Michael J.Pelzer et.al., (5th ed), Tata McGraw Hill, New Delhi (1993).
2. General Microbiology- by Hans G.Schlegel, CLPE, cambridge University Press, (1995).
3. Introduction to Environmental microbiology- by Ralph Mitchell, PH Int, Engle Wood Cliffs, New Jersey (1974).
4. Water pollution Microbiology (vol.2) by Mitchell, R.(ed), Wiley-Inter Science, New York (1978).
5. Water Supply and Pollution Control by W. Viessman Jr. and M.J. Hammer, Harper and Row, NY 1993.

Date: 28th November 2008

(Dr SK Maiti) 28/11/08

Department of Environmental Sc. & Engg.
ISM University, Dhanbad

M.Tech (Env. Sc.& Engg.) - II Semester

LECTURE PLAN: ES C521 02: WASTEWATER ENGINEERING [3 - 1 =07]

TOPICS	IIr.
1. Introduction, role of wastewater engineer; Sewage characteristics: Quantity & Quality: Physical, chemical & biological; flow rate, treatment flow - sheets.	2 (SKM)
2. *Sewage treatment process*, reactor type, hydraulic characteristics, C-diagram, calculation of dispersion number, types of biological reactor	2 (SKM)
3. *Preliminary treatment:* Design and operation of *screening*	**2 (SKG)**
4. *Preliminary treatment:* Design and operation of *grit chamber.*	**1 (SKG)**
5. *Primary Treatment*: Sedimentation, design and operation of *circular PST*	**2 (SKG)**
6. *Sanitation*- rural sanitation, sewage disposal in isolated unsewared areas-septic tank, cesspool and their effluent disposal methods.	**2 (SKG)**
7. *Chemical treatment*: Chemical precipitation; Flash mixer, clariflocculator	**2 (SKG)**
8. *Principles of biological treatment*: derivation of bacterial growth kinetics used in designing of wastewater treatment plant.	2(SKM)
9. *Process design and operation of Activated sludge process*. Bulking and raising sludge; Design of secondary settling tank.	2 (SKM)
10. *Modification on Activated sludge process*: DSR, Contact stabilisation, SBRs	2 (SKM)
11. *Wastewater treatment for small communities*: Oxidation ditch, Extended aeration system	2 (SKM)
12. *Mechanically Aerated lagoon*: process design, operation and problems.	2 (SKM)
13. *Waste stabilization pond system*: types , oxygen production and algal washout, design based on organic loading rate and BOD kinetics, anacrobic activity, microbial activity in pond, N and Phosphorus removal.	2 (SKM)
14. *Aerobic Attached Growth Process*: Process design and operation of trickling filter, RBC, Biofilter.	2 (SKM)
15. *Anaerobic Treatment*: Process microbiology and biochemistry: application of treatment of sewage; anaerobic reactors, UASB.	2 (SKM)
16. *Floating aquatic plant* system and its design and operation	1 (SKM)
17. *Advance wastewater treatment system*: biological removal of nitrogen and phosphorous. Design and operation of biological nitrification - denitrification system; luxurious phosphorus uptake.	3 (SKM)
18. *Sludge characteristics and disposal methods:* Design & operation of sludge drying bed. Design and operation of treatment plant. Trouble shouting and trouble free operation.	1 (SKM)

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19. Industrial wastewater treatment - Specific characteristic of industrial wastewater; Design of equalization tank; Design of GAC tower	2 (SKG)
20. Design of Clariflocculator tank and calculation of dose and chemical sludge generation	2 (SKG)
21. RO process - removal of solutes from water by RO process, membrane materials, design of membrane requirements; Ion exchange process	2 (SKG)
22. Industry specific unit operation and characteristics of wastewater generation, environmental impacts, effluents treatment - recovery/ recycling of chemicals, chemical, aerobic and anaerobic treatment of wastewater, with reference to - • Pulp & Paper	2 (SKG)
• Breweries, wineries and Distillery	(2) (SKG)
• Tannery waste	(1) (SKG)
• Textile mill waste	(1) (SKG)
• Fertliser plant waste	(1) SKG
• Electroplating	(1) (SKG)
• Chloro-alkali	(1) (SKG)
23. Coal washery - characteristics, pollution load and treatment, Coke oven effluent treatment - characteristics, treatment of phenol by carbon oxidation, ammonia by nitrification & denitrification,	2 (SKG)
24. Acid mine drainage: occurrence, effects & treatment	2 (SKG)
25. Mid-term test	*2*
(SKM- 25; SKG – 28) TOTAL	**53 + 2**

Books and References

1. *Wastewater Engineering: Treatment, disposal, Reuse* by **Metcalf & Eddy** Inc. (4th ed.), TMGHI, New Delhi, 2003.
2. *Environmental Engineering* by Peavy, H.S. Donald R. Rowe & G. Tchobanoglosus, MGH Int. Ed. New York, 1985.
3. *Wastewater treatment for pollution Control* by Soli J Arceivala, Tata McGraw Hill, (2nd ed.) 1998
4. *Wastewater Treatment* by Rao & Datta, Oxford & IBH Pub Co Pvt Ltd., Calcutta, 1987.
5. *Environmental Engineering* by Gerald Kiely, Irwin McGraw Hill, Singapore, 1998 (Int ed)
6. *Biological process design for wastewater treatment* by L. D. Benefield & C.W .Randall, PH, Englewood Cliff, NJ, 1980
7. *Wastewater treatment Plants: Planning, Design and Operation* by S. R.Qasim, Holt, Rinehart and Winston, NY, 1985
8. *Industrial Water Pollution Control* by W.W.Eckenfelder,Jr., McGraw -Hill, 2nd Edition, NY 1989
9. *Biological Wastewater Treatment: Theory and Application* by C.P.L. Grady & H.C.Lim, Marcel Decker, NY 1980
10. *Process design techniques for Industrial Waste treatment* by C.E. Adams, (Jr). & W.W. Eckenfelder Jr. , ENVIRO Press nashrille,1974

Date: 23 -11-2008

(S.K.Gupta) 23/11/08
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(S.K. MAITI) 23/11/08
CME/ ISM

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Department of Env Sc. Engg: ISM University, Dhanbad

M.Tech (Env. Sc.& Engg.) - II semester:: LECTURE PLAN:

ESC 51203

~~CM~~ **C512 03: SOLID & HAZARDOUS WASTE MANAGEMENT & LAND RECLAMATION [3-1=7]**

Section B: LAND RECLAMATION (Dr SK Maiti)	Cr. Hr
1. Biomedical waste categorization- generation, collection, transport, treatment & disposal	2
2. Hazardous waste,- landmark episodes, classification, generation, guidelines for HWM, regulatory frame work in the USA, and India, Basal convention.	2
3. Physical reclamation -regarding and re-contouring, terracing, slope preparation, segregation and burial of toxic substances, reclamation alternatives, reclamation equipments, scheduling and costs.	3
4. Biological reclamation: an overview; Factors affecting establishment of vegetation in overburden dumps and mined ouit areas; physical, chemical and biological characteristics and affects of pollution.	3
5. Analysis and evaluation of overburden sites, soils & plants.	3
6. Site preparation - Topsoil management, minesoil genesis and evaluation, amendments; organic & inorganic mulches, fertliser. Nursery development and planting; Seeding method. Vegetation establishment & selection of plant species.	3
7. Innovation in biological reclamation; mycorrhiza.	2
8. Management & aftercare of reclaimed land/ plantation stock	2
9. Current bioremediation practices & application; bioremediation system & process, in-situ bioremediation, Case studies	2
TOTAL	(22)

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Date: 28-11-2008

(S.K. MAITI) 28/11/08

:: BOOKS AND REFERENCES ::

1. *Solid waste: Engineering principles and Management Issues* By G.Tchobanoglous, G.H. Theisen and R. Eliassen, McGraw Hill international edition, Singapore, 1977. (available at ISM Central Lib)
2. *Handbook of Solid Waste Management* -- by F Kreith, McGraw Hill, NY 1994. (available at ISM Central Lib)
3. *Solid waste: Origin, Collection, Processing and Disposal* -- by C.L Mentall, John Wiley & sons, NY, 1975. (available at ISM Central Lib)
4. *Hazardous Waste Management* (2nd Ed) - Lagrega, MD, PL Buchingham & JC Davis, McGraw Hill, NY, 2001.
5. *Environmental Engineering* -- by HS Peavy D R Rowe & G Tchobanoglous, McGraw Hill Int Edition, Singapore, 1985. (available at ISM Central Lib)
6. *Handbook of Solid waste Disposal* -- by J.L. Pavoni, J.E.Heer,Jr & D.J. Hagerty, Van Nostrand Reinbold, NY, 1975. (available at ISM Central Lib)
7. *Quarry Reclamation* -- by NJ Coppin and A.D.Bradshaw, Mining Journal Books, London,1982. (available at ISM Central Lib)
8. *Surface Mining Reclamation Manual* -- by Lyle,E..S (Jr.), Elseiver, 1987.
9. *Surface Mining, Environmental Monitoring & Reclamation Handbook* -- by L.V.A. Sendlein, H Yazicigil and C.L. Carlson, Elsveir, 1983. (available at ISM Central Lib)
10. *The Reclamation of former /Coal mines and Steelworks* -- by I.G. Richards, J. P. Palmer and.A.Barratt, Elsveir, London,1993. (available at ISM Central Lib)
11. *Biological Reclamation of Solid waste* -- by C.G.Goluek, Todale Press, Emmaus, Penn, 1977.
12. *Sanitary Landfill Design Handbook* -- by Nobel G, Technimic, Westport, Conn, 1976.

Department of Environmental Science & Engg
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Date: 28-11-2008

Discipline: M.Tech II Semester (Biomineral Processing) ESC 52109

Lecture plan: ~~CM E 521 01~~: Biotechnology & Informatics 3-0-0 =6

S.N	Topics	Con. Hrs
1.	Introduction to environmental biotechnology- scope & importance;	2
2.	Microorganisms & energy requirements of mankind: Production of non-conventional fuels, Biomass resources for fuel generation; biomass strategy; Methane (biogas) as energy source; Alcohol as fuels, & algal hydrocarbons; Biological hydrogen generation,	4
3.	Wastewater (sewage & industrial effluents) treatments: characteristics of wastewater; Aerobic & Anaerobic treatment, Treatment flow sheets;	6
4.	Microbiology & biochemistry of aerobic & anaerobic treatment processes.	4
5.	Conventional and advanced treatment Technology using biosystems – Activated sludge process (ASP); Trickling filter; Rotating Biological Contractor (RBC); Fluidized Beds; technology Methanogenesis, methanogenic, acetogenic and fermentive bacteria – technical process & conditions.	6
6.	Emerging biotechnological process in wastewater treatment	2
7.	Mining & Metal biotechnology – Bioleaching & biosorption; microbial transformation, accumulation & concentration of metals, metal leaching, extraction & future prospects. Bio-sorbent microbial groups – bacteria, fungi, algae & macrophytes.	4
8.	Microbial leaching & mining- extraction of metals from ores; recovery of metals from solution; Microbes in petroleum extraction; Microbial desulfurization of coal	4
9.	Total	32

References & Text books:

1. *Environmental Biotechnology: Principles and Applications* by Rittmann and PL McCarty, McGraw-Hill International Ed, Singapore, 2001. (Very good book).
2. ***Environmental Biotechnology* by BC Bhattacharyya and Rintu Banerjee, Oxford University Press, New Delhi, 2007. (Available in India, Rs. 275=00)**
3. ***Introduction to Environmental Biotechnology* by AK Chaterji, PHI (2002) (Available in India Rs. 120=00) (for Sl. 2).**
4. *Fundamental & Applied Biohydromettalurgy* by Lawrence, RW (ed), Elsevier (1986).
5. *Wastewater Engineering*- Melcaf & Eddy Inc (2003), TMG. (Good for wastewater engg portion for sl no. 3,4,5; Available in India, Rs. 550=00)

CC: M.Tech (II Sem) – Biomineral Processing students
Dr NR Mandre, FME, CC
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(Dr SK Maiti)/ ESE 28/11/08