UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)
(Uttarakhand Act No. 11 of 2013)
Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advanced Concrete Technology		

Objectives of the Course:

1. To learn about the processing, hydration and microstructure of cements and characterizing the engineering properties of cement-based materials.
2. To gain specialized knowledge of the mechanical performance of, and how to manage, cement-based materials.
3. To recognize the construction and engineering characteristics of unique concrete mixtures such as high-performance concrete, self-consolidating concrete, fiber-reinforced concrete, sprayed concrete, etc.

4. To bridge the gap between the science of materials and structural engineering in order to better use concrete in structural concrete projects.

UNIT I (Total Topics-12 and Hrs- 10)

Review of properties of cement, their physical and chemical properties, special purpose cements, Classification and properties of aggregates, soundness of aggregates, alkali aggregate reaction, thermal properties of aggregates, Importance of shape and Surface area and grading, gap graded and aggregates. Admixtures & construction chemicals, Use of Fly Ash, Silica Fumes, Metakaolin & GGBS in concrete.

UNIT II(Total Topics- 10 and Hrs- 8)

Rheological behavior of concrete, requirements of workability of concrete, Effect of environmental conditions, Strength properties of hardened concrete, Impact, Dynamic and fatigue behavior of concrete, shrinkage and creep of concrete, behaviour of concrete under fire.

UNIT- III (Total Topics- 12 and Hrs- 10)

Permeability and Durability of concrete, Parameters of durability of concrete, chemical attack on concrete, Production of concrete; batching mixing, transportation, placing, compaction of concrete. Special methods of concreting and curing of concrete, Hot weather and cold weather concreting, Guniting (Shotcreting).

UNIT IV(Total Topics- 15 and Hrs- 10)

Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method. Quality control and quality assurance of concrete, Acceptance criteria, Quality management in concrete construction, Inspection and testing of concrete. Non-destructive testing of concrete, core test and load test. Prestressed concrete construction-Principle, methods, materials, Tools and equipment for theconstruction of a prestressed bridge.

UNIT V (Total Topics- 15 and Hrs- 10)

Special concrete such as high strength, Lightweight, heavy weight, vacuum processed concrete. Mass concrete, high performance concrete, Pumpable concrete, Self Compacting concrete, Air entrained concrete,

Ferro cement, fiber reinforced concrete, Polymer impregnated concrete. Jet concrete. Deterioration and repair technology of concrete, Distress and type of repairs, crack sealing techniques**.**Special construction methods: Construction in Marine environments, High rise construction.

Course Outcomes (CO)

CO1: Assess the importance of cement, aggregates and admixtures in concrete production.
CO2: Study the role of workability, strength and fatigue behavior of concrete.
CO3: Justify the impact of Permeability, durability and Special methods of concreting.
CO4: Design a concrete mix as per Indian standards.
CO5: Distinguish the different types of concrete like light weight concrete.

Reference Books:

1. Neville A.M., J.J. Brook Properties of Concrete Addison Wesley 1999.
2. Gambhir M.L: Concrete Technology Tata McGraw Hill (Second Edition) 1995.
M.S. Shetty, Concrete Technology S.Chand& Company New Delhi 2005.
3. Edward Nawy , Concrete Construction and engineering Handbook , CRC Press.
4. Orchard D.F.; Concrete Technology -Vol I. & II Applied Science Publishers (Fourth Edition) 1979.

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Programme Name	**Pre-Ph.D. Course Work**	Programme Code	23-
Course Code	DSE704 (i)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advanced Water And Wastewater Treatment		

Objectives of the Course:

1. To investigate various socio-technical issues related to the selection of suitable water and wastewater treatment technologies.
2. To create a requirement analysis, system design and detailed design for an advanced water and wastewater treatment system.
3. To design the membrane processes for water purification, desalination and wastewater treatment including general and specific membrane problems.
4. To apply recommendations for appropriate treatment processes for upgrading water and wastewater treatment efficiency for environmental sustainability using prototype

UNIT I (Total Topics- 12 and Hrs- 8)

Introduction, Conventional water treatment, rapid mixing, coagulation-flocculation, sedimentation, filtration and disinfection.

UNIT II(Total Topics- 15 and Hrs- 10)

Natural purification of water, filtration systems for water treatment, membrane systems, microfiltration, nanofiltration, ultra filtration, reverses osmosis. Ion exchange and demineralization, adsorption, different types of adsorption, adsorption isotherms, adsorption kinetics in batch reactors, breakthrough curve and design of fixed absorber.

UNIT- III (Total Topics- 12 and Hrs- 10)

Disinfection and advanced oxidation processes, advanced disinfection techniques. Removal of nitrate, fluoride, iron, manganese, arsenic etc. from water .Introduction to conventional aerobic and anaerobic methods of sewage treatment.

UNIT IV(Total Topics- 15 and Hrs- 10)

Wastewater treatment for carbon and nitrogen removal, biological nitrification and de-nitrification, activated sludge process, design for nutrient removal, process operation, food to microorganism ratio (F/M), mean cell residence time, oxygen requirement. Biological and chemical phosphorous removal, process design and operation.

UNIT V(Total Topics- 10 and Hrs- 10)

Bio-membrane processes for wastewater treatment, types of membrane bioreactors, design,

operation and maintenance. Downstream wastewater treatment for reuse and recycle, need for down stream processing, guidelines for wastewater recycling, small and package plants for water and wastewater treatment.

Course Outcomes (CO)

CO1: Identify numerous socio-technical problems related to the selection of suitable technologies for handling water and wastewater.

CO2: Measure a criteria review for comprehensive system design for an advanced water and wastewater treatment facility,

CO3: Model membrane processes including general and particular membrane problems for water purification, desalination, and wastewater treatment.

CO4: Provide sound knowledge of recommendations for appropriate treatment processes to upgrade water and wastewater treatment efficiency for environmental sustainability using prototype.

Reference Books:

1. "Wastewater Engineering – Treatment and Reuse", Metcalf and Eddy, Tata McGraw Hill
2. "Theory and Practice of Water and Wastewater Treatment", Droste, R.L., John Wiley.
3. "Water Treatment Processes : Simple Options", Vigneswaran, S. and Visvanathan, C.,CRC.
4. "Introduction to Environmental Engineering", Davis, M.L. and Cornwell, D.A., McGraw Hill.
5. "Environmental Engineering Science", Nazaroff, W.W. and Alvarez-Cohen, L.,John Wiley.
6. "Water and Wastewater Technology", Hammer, M.J. and Hammer, M.J. Jr., PHI.