SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Biotechnology	LP: BT 18401 Rev. No: 02 Date: 07.02.2023
~~B.~~E/B.Tech/~~M.E/M.Tech~~ : **Biotechnology** Regulation:2018A PG Specialisation : NA Sub.Code/Sub.Name : BT 18401/ FLUID MECHANICS AND HEAT TRANSFER Unit : I	

UNIT I CONDUCTION, CONVECTION & RADIATION HEAT TRANSFER **10+3**

Conduction: Fourier's law, Heat conduction through plane and composite walls, Cylinders. Critical radius of insulation, Overall heat transfer coefficient, Extended surfaces, Types of fins, Fin efficiency, Fin effectiveness. Convection: Combined conduction and convection, Forced and free convection, Boiling and condensation, Radiation: Absorptivity, Reflectivity and Transmissivity, Black, white and grey body, Emissive power and emissivity, Laws of radiation – Planck law, Stefan-Boltzmann law, Wein"s displacement law, Kirchhoff"s law. Shape factor, radiation shield.

OBJECTIVE: To introduce the basis of heat transfer mechanisms and learn about conduction, convection, radiation in detail.

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Introduction to Heat Transfer, Fourier's law	T1-(235-240)	LCD
2.	Conduction Heat Transfer-Conduction through plane and composite walls, Hollow cylinder	T1-(236-244)	LCD
3.	Critical radius of insulation	T1-(330-334)	BB
4.	Overall heat transfer coefficient, Extended surfaces	T1-(244-246)	BB/GCR
5.	Types of fins, Fin efficiency, Fin effectiveness	T1-(249-251,357-361)	LCD
6.	Convection: Combined conduction and convection	T1-(249-251)	LCD
7.	Forced and free convection, Boiling and condensation	T1-(283-291) R1-(10.1-10.5)	LCD
8.	Radiation: Absorptivity, Reflectivity and Transmissivity, Black, white and grey body, Emissive power and emissivity	T1-(296-299)	LCD
9.	Laws of radiation – Planck law, Stefan-Boltzmann law, Wein"s displacement law, Kirchhoff"s law	T1-(534-544)	BB
10.	Shape factor, radiation shield.	T1-(534-544)	LCD
11.	Problems- Conduction	T1-(236-244)	BB
12.	Problems- Convection	T1-(249-251)	BB
13.	Problems- Radiation	T1-(534-544)	BB

Content beyond syllabus covered (if any):
The importance and mechanism of heat transfer in Bioreactors

* Session duration: 50 minutes

Sub. Code / Sub. Name : BT 18401 / **FLUID MECHANICS AND HEAT TRANSFER**
Unit : II

UNIT II HEAT TRANSFER EQUIPMENTS 10+3

Shell and tube heat exchanger: LMTD for parallel and counter flow exchanger, Design of heat exchangers, Fouling factor, Effectiveness. Evaporators: Short tube vertical evaporator, Long tube vertical evaporator, Rising film evaporator, Falling film evaporator, Agitated thin film evaporator. Single and multiple effect evaporators, Types of feeding, Heat transfer in fermenter.

OBJECTIVE: To learn the application of various heat transfer equipment.

Session No *	Topics to be covered	Ref	Teaching Aids
14.	Shell and tube heat exchanger	T1-(291-295 R1-(11.1)	LCD
15.	LMTD for parallel and counter flow exchanger	T1-(296-300)	LCD
16.	Design of heat exchangers	T1-(297-299) R2-(564-569)	LCD
17.	Fouling factor, Effectiveness	R1-(11.4)	LCD
18.	Evaporators:	T1-(527-530)	LCD
19.	Short tube vertical evaporator, Long tube vertical evaporator,	R1-(11.2-11.3	LCD
20.	Rising film evaporator, Falling film evaporator, Agitated thin film evaporator	T1-(531-534)	LCD
21.	Single and multiple effect evaporators	T1-(531-534)	LCD
22.	Types of feeding evaporators	T1-(534-544)	LCD/GCR
23.	Heat transfer in fermenter	T1-(534-544)	LCD
24.	Problems- Heat exchanger	T1-(297-299) R2-(564-569)	BB
25.	Problems- LMTD	T1-(296-300)	BB
26.	Problems-Evaporators	T1-(527-534)	BB

Content beyond syllabus covered (if any): Use of different types of heat exchangers in Bioprocessing industries.

* Session duration: 50 mins

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name : BT 18401 / **FLUID MECHANICS AND HEAT TRANSFER**
Unit : III

UNIT III FLUID PROPERTIES **9+3**

Properties of fluids: Density, Specific Gravity, Viscosity, Compressibility, Vapour pressure, Capillarity and surface tension, Static pressure, Absolute and gauge pressures, Pressure measurements by manometers, Newtonian and non-Newtonian fluids, Dimensional Homogeneity and methods of dimensional analysis: Rayleigh"s method, Buckingham Pi theorem,

OBJECTIVE: To impart knowledge on the properties of fluids.

Session No *	Topics to be covered	Ref	Teaching Aids
27.	Properties of fluids	T2- CH.2;Pg.34-35	LCD/BB
28.	Density, Specific Gravity, Viscosity, Compressibility	T2- CH.2;Pg. 35-43	LCD/BB
29.	Vapour pressure, Capillarity and surface tension,	T2- CH.2;Pg. 47-51	LCD/BB
30.	Static pressure, Absolute and gauge pressures	T2- CH.2;Pg. 88-106	LCD/BB
31.	Pressure measurements by manometers,	T2- CH.3;Pg. 121-136	LCD/BB/ GCR
32.	Newtonian and non-newtonian fluids	T2- CH.3;Pg. 121-136	LCD/BB/ GCR
33.	Dimensional Homogeneity	R2-(244-257)	LCD/BB
34.	Methods of dimensional analysis	R1-(6.4.1-6.4.3)	LCD/BB
35.	Rayleigh's method, Buckingham Pi theorem	R1-(6.4.1-6.4.3)	LCD/BB
36.	Rayleigh's method- Problems	R1-(6.4.1-6.4.3)	LCD/BB
37.	Buckingham Pi theorem- Problems	R1-(6.4.1-6.4.3)	LCD/BB
38.	Pressure- Problems	T2- CH.2;Pg. 88-136	LCD/BB
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name : BT 18401 / **FLUID MECHANICS AND HEAT TRANSFER**
Unit : IV

UNIT IV FLUID FLOW MEASUREMENTS. 8+3

Continuity equations, Bernoulli's theorem. Flow through packed and fluidized beds: Fluidization, minimum fluidization velocity, Laminar and turbulent flow: Reynolds Number. Venturi meter, orifice meter, Rotameter, Rectangular and triangular notch, Nozzle, Pitot tube.

OBJECTIVE: To gain knowledge on the various fluid flow measuring devices

Session No *	Topics to be covered	Ref	Teaching Aids
39.	Continuity equations	T2-(238-243)	LCD
40.	Bernoulli's theorem	T2-(243-251)	LCD
41.	Flow through packed and fluidized beds	T2-(251-259)	BB
42.	Fluidization, minimum fluidization velocity	T2-(259-264)	LCD
43.	Laminar and turbulent flow	T2-(265-269)	LCD/GCR
44.	Reynolds Number	T2-(270-278)	LCD
45.	Venturi meter	T2-(270-278)	LCD
46.	Orifice meter	T2-(278-281)	LCD
47.	Rotameter, Rectangular and triangular notch	T2-(278-281)	LCD
48.	Nozzle, Pitot tube	T2-(282-241)	BB
49.	Problems	T2-(282-241)	BB
Content beyond syllabus covered (if any):			

* Session duration: 50 mins

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Sub. Code / Sub. Name : BT 18401 / **FLUID MECHANICS AND HEAT TRANSFER**
Unit : V

UNIT V FLUID TRANSPORT **8+3**

Pumps: Reciprocating pumps, Centrifugal Pumps and Peristaltic pumps: Working, Advantages, disadvantages & its applications, NPSH, Compressors and valves.

OBJECTIVE: The students will gain knowledge on the types of fluid transporting equipments

Session No *	Topics to be covered	Ref	Teaching Aids
50.	Pumps- introduction	T2- CH.2;Pg.34-	LCD/BB
51.	Pumps- types	T2- CH.2;Pg. 35-43	LCD/BB
52.	Reciprocating pumps- Working, Advantages, disadvantages & its applications	T2- CH.2;Pg. 47-51	LCD/BB
53.	Centrifugal Pumps- Working, Advantages, disadvantages & its applications	T2- CH.3;Pg. 136-144	LCD/BB/ GCR
54.	Peristaltic pumps- Working, Advantages, disadvantages & its applications	T2- CH.3;Pg. 136-144	LCD/BB/ GCR
55.	Peristaltic pumps- Working, Advantages, disadvantages & its applications	T2- CH.3;Pg. 136-144	LCD/BB
56.	NPSH	T2- CH.2;Pg. 88-106	LCD/BB
57.	Compressors	T2- CH.3;Pg. 121-136	LCD/BB
58.	Valves	T2- CH.3;Pg. 121-136	LCD/BB
59.	NPSH- Problems	T2- CH.3;Pg. 144-154	LCD/BB
60.	Revision	T2- CH.3;Pg. 144-154	BB

Content beyond syllabus covered (if any):

* Session duration: 50 mins

Sub Code / Sub Name: BT 18401 / **FLUID MECHANICS AND HEAT TRANSFER**

TEXT BOOKS:

1. McCabe, W.L., Smith, J.C and Harriot, P., "Unit Operations of Chemical Engineering", 7th Edition, McGraw Hill, 2014
2. Geankoplis, C.J., "Transport Processes and Separation process Principles", 4th Edition, PHI, 2015.

REFERENCES:

1. J.M.Coulson and J.F.Richardson: Chemical Engineering VoI 1. Fluid flow, Heat Transfer and Mass Transfer. Butterworth,Heinemann, an imprint of Elservier, Sixth Edition, Indian Reprint, 2006.
2. Rajput, R.K. "Heat and Mass Transfer: A Textbook for the Students", 3rd Edition, S. Chand Limited, 2015.

	Prepared by	Approved by
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Designation	Associate Professor	HOD
Date	07-02-2023	07-02-2023
Remarks *: The Same lesson plan will be followed in the subsequent year		
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD