NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

This course outline template acts as a guide for writing your course outline. As every course is different, please feel free to amend the template/ format to suit your requirements.

COURSE OUTLINE TEMPLATE			
Course Title	**FUELS, COMBUSTION AND EMISSION CONTROL**		
Course Code	**ME 601**	**No. of Credits**	**3**
Department	**MECHANICAL**	**Faculty**	**Dr.M.UDAYAKUMAR**
Pre-requisites Course Code	**ME 203**		
Course Coordinator(s) (if, applicable)	**NIL**		
Other Course Teacher(s)/Tutor(s) E-mail	**NIL**	**Telephone No.**	**9487257871**
Course Type	**Core course**		

COURSE OVERVIEW

- **Review of the Fuels, combustion chemistry, thermodynamics, fluid mechanics to enable the student apply them for the study of combustion**
- **Apply the above sciences along with additional inputs of mass transfer and kinetics to formulate mathematical models to study combustion**
- **Formulate and obtain solutions for simplified models for laminar flame propagation, diffusion flames, turbulent flames and for droplet evaporation and coal particle combustion**
- **Study different types of comustors(liquid ,gas and solid firing), atomisers, stokers, cyclone combustor and P-F burners, FBC and CFBC systems.**
- **Study emissions with emphasis on emission index , formation of CO, NOx and unburnt HC. Control of emissions by SCR, SNCR.**

COURSE OBJECTIVES

-Integrate the knowledge of combustion chemistry, thermodynamics, fulid mechanics , mass trnsfer and kinetics to formulate mathematical models for combustion systems and analyse them

- **Impart knowledge of various types of burners and combustors operated with solid, liquid and gaesous fuels**
- **Provides ability to convert emission measurements to different forms and get insight in to the formation of combustion related pollutants and their control techniques.**

COURSE OUTCOMES (CO)

Course Outcomes	**Aligned Programme Outcomes (PO)**
On completion of the course, the students will be able to: 1. recall the types of fuels and their distinctive properties, combustion chemistry and stoichiometry. 2. identify the factors influencing flame characteristics and formulate models using the conservation equationsto study different combustion parameters. 3. compare different types of combustion systems and model the entire Fluidized Bed Combustion (FBC) phenomenon. 4. explain the formation of pollutants and discuss control mechanism of emissions, and emission index for premixed and non-premixed combustion.	**PO-1, PO-2, PO-3, PO-4, PO-5,PO-6, PO-7, PO-8, PO-9, PO-10, PO-11, PO-12**

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	**Week**	**Topic**	**Mode of Delivery**
1	**WEEK-1** **WEEK-2** **WEEK-3**	**Introduction to combustion, Review of thermodynamics, combustion chemistry** **Stoichiometry, calculation of HHV and LHV, heat of reaction** **Adiabatic flame temperature, Chemical equilibrium, Kp, Determination of equilibrium composition**	**Chalk and Talk**

	WEEK-4	**Simplified proc.to get eq. composition Mass transfer-Ficks law Stefan problem**	
	WEEK-5	**Droplet evaporation, transfer no., droplet evaporation time, Problems on mass transfer**	
	WEEK-6	**Introduction to kinetics, Reaction mechanismproof for Kp= Kc , first order rate coefft., chain reactions**	
	WEEK-7	**Reaction mechanisms for HC molecules. Combining thermodynamics to reactive systems**	
	WEEK-8	**Review of mass, momentum and energy eqs., Conserved scalar concept. Laminar premixed flames, characteristics, simplified Spalding model for S_L and δ**	
	WEEK-9	**Fuels- their types, Characterisation of coal. Determination of HHV – calorimeters, DSC, TGA, CHNSO analysers. Kinetic theory applied to Binary diffusion and kinetics rate coeffts.**	**Seminars with ppts**
	WEEK-10	**Const. pr, const. vol reactor, well stirred reactor and plug flow reactor models, Effect of pr. and Temp on S_L and δ. Diffusion flames, models to analyse them**	
	WEEK-11	**Turbulent flames, turbulent flame velocity correlations, droplet evaporation model, solution to model**	
	WEEK-12	**Stokers, FBC CFBC and p-f combustors, cyclone furnace, atomisers for liquid fuels, gas burners.**	
	WEEK-	**Burning of solid carbon partice,**	

	13 **WEEK-14**	**model and solution, Emission Index and corrected conc. HC, CO and NOX formation mechanisms** **Pollutaion control techniques, SCR, SNCR, Staged combustion, Catalytic converters for SI engines.**		
COURSE ASSESSMENT METHODS				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	**Cycle Test-1**	**7th week**	**1 Hour**	**20%**
2	**Cycle Test-1**	**12th week**	**1 Hour**	**20%**
3	**Retest**	**14th week**	**1 Hour**	
4	**Seminar**	**9th week – 14th week**		**10%**
5			**3 Hour**	**50%** **Total = 100 Marks**

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. **S.R. Turns, "An introduction to Combustion", 3 Ed., McGraw Hill, 2012**
2. **Archie W Culp, " Principles of energy conversion", McGraw Hill, 1991**
3. **Amitava Datta, "Combustion- Fundamentals and applications", Narosa, 2017.**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

1. **Feedback from students during class committee meeting**
2. **Anonymous feedback through questionnaire (as followed currently)**

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. **Test 1 and Test2 will be conducted in the class. Use of approved Tables and scientific calculator permitted**
2. **75% attendance compulsory for wrting the end semester examination**

ADDITIONAL COURSE INFORMATION

The Faculty is available for consultation after the class hours in the Mech. Engg. Dept. Faculty may also be contacted on mobile : 9487257871

FOR SENATE'S CONSIDERATION

Course Faculty _____ CC-Chairperson _____ HOD _____