INFORMATION BROCHURE

Master of Technology (Thermal Engineering)

(An Accredited Post Graduate Programme by National Board of Accreditation, India)

National Institute of Technology Raipur

Address:

Department of Mechanical Engineering

National Institute of Technology Raipur

G.E. Road, Raipur, Chhattisgarh 492010, INDIA.

ABOUT THE INSTITUTION

In view of the fact of a young nation and also with an aim of harnessing the ample mineral resources of the region, this institute, presently recognized as NIT Raipur, was set-up on 1st May 1956 as Government College of Mining and Metallurgy. The first President of independent India honourable Dr. Rajendra Prasad laid the Foundation stone of the college building on 14th September 1956.

The construction work was completed in 1962 and on 14th March 1963, India's first Prime Minister Pt. Jawaharlal Nehru performed the inauguration. The first session of the college commenced from 1st July 1956 with the admission of 15 students each in Mining and Metallurgy Engineering. In 1958-59 with the commencement of additional courses in Civil, Mechanical and Electrical Engineering the college came to be known as Government College of Engineering and Technology. Later graduate courses in Chemical Engineering (1965), Architecture (1984), Electronics (1985), Information Technology, Computer Science and Technology (2000), Biotechnology, Biomedical Engineering (2003) were also started. In view of its great past with 50 years old record of excellence and several strengths, the institute has been declared as National Institute of Technology (NIT) by the Central Government on 1st Dec. 2005.

National Institute of Technology, Raipur (NITRR), hence formed in the year 2006, is an Institute of national importance and presently runs academic courses in 12 disciplines in the form of graduate and post graduate courses. The institute also inducts regular and part-time scholars for PhD courses. In addition to these, the institute intends to provide continuing education in a very broad spectrum keeping in view the needs of industries, academic institutions, research organizations and, last but not the least, the society. The institute is committed to the challenging task of development of technical education by preparing seasoned graduates in highly sophisticated field of engineering and technology. Development of India as an emerging industrial power is a demanding exercise as it involves the combination of cost effectiveness and efficiency along with producing world-class technology at the cutting edge. For about five decades we have been doing it with utmost sincerity and commitment at NIT Raipur.

ABOUT THE DEPARTMENT

Established in the year 1958, today the department offers undergraduate program (B. Tech.) in Mechanical Engineering and Postgraduate program (M. Tech.) in Thermal Engineering. It is one of the largest departments of the institute with intake of 100 students for undergraduate course and 19 students for post graduate course. Department also offers Ph.D. program in all relevant discipline of Mechanical Engineering including Design, Production, Thermal and Industrial Management.

Vision: -

- To produce innovative, entrepreneurial and successful engineers and technologists of high caliber for the nation, to serve as a valuable resource for industry and society.

Mission: -

- To provide the students and the faculty with opportunities to create, interpret, and apply the knowledge in the field of Mechanical Engineering.
- Provide technological service to local, national, and international communities.

Programme Educational Objectives (PEOs):-

Under the undergraduate Mechanical Engineering programme the objectives and aims to produce qualified Mechanical Engineers who will:

- Apply technical knowledge and skills as Mechanical Engineers to provide the solutions for the industries and government organizations.
- Utilize effective communication, team, and project management skills to work productively within their professions and communities.
- Conduct themselves in a responsible, professional and ethical manner.
- Inculcate an attitude for lifelong learning process.

Programme Outcomes (POs):-

Program Outcomes are the expected qualities of a graduating engineer. They represent the views of industry and institute, and the needs of jobs performed by graduates and are listed below for the graduates to:

- Acquire knowledge of basic sciences and Mechanical Engineering.

- Acquire an ability to identify, formulate and solve Mechanical engineering problems.
- Acquire an ability to design and conduct experiments and analyze and interpret data related to mechanical engineering.
- Acquire skills to use modern mechanical engineering tools, software and equipment to analyze problems.
- Acquire knowledge of professional and ethical responsibilities and develop an understanding of impact of mechanical engineering solutions on the society.
- Communicate effectively both verbal and written, as an individual or as a leader.
- Acquire awareness of contemporary issues.
- Participate and succeed in competitive examinations.

M.TECH. IN THERMAL ENGINEERING

About The Programme:

PROGRAMME COORDINATOR: **Dr. Vivek Kumar Gaba**

(SCAN THE QR FOR MORE INFORMATION)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Under the Post-Graduate Mechanical Engineering programme in **Thermal Engineering** the objectives aim to produce qualified Mechanical Engineering Post- Graduates who will:

- ✓ Possess advanced knowledge and understanding of the specialization thus enabling them to tackle on-field problems as well as pursue further academic achievements through research.
- ✓ Possess communication, analytical and problem solving skills.
- ✓ Conduct themselves in a responsible, professional and ethical manner.
- ✓ Inculcate an attitude for life-long learning process.

PROGRAMME OUTCOMES (Pos):

- ✓ Possess knowledge of modern technological concepts, conduct in-depth studies and experiments and apply specialized expertise practically.
- ✓ Work on multi-disciplinary projects to enhance skills, make effective oral presentations and prepare technical documents effectively.
- ✓ Develop professional and ethical attitude and become socially responsible citizens.
- ✓ Ability to understand global issues and conduct independent research in the emerging areas.

FACULITY OF THERMAL ENGINEERING:-

NAME	DESIGNATION	EDUCATION	AREA OF INTEREST
Dr. R. Salhotra	Professor & HOD	B. E., M .Tech, Ph.D.	Heat Transfer, Thermodynamics, Thermal Engineering
Dr. S. Sanyal	Professor & TEQIP Coordinator	B. E., M. E., Ph. D., PG Diploma (English)	Machine Design, Mechanism Synthesis, Stress Analysis.
Dr. S L Sinha	Professor	B. E., M .Tech, Ph.D.	Computational Fluid Dynamics in Thermal Engg.
Dr. S.D. Patle	Professor	B. E., M .Tech, Ph.D.	Thermal Energy & Environmental Engineering.
Dr. Anil Kr Tiwari	Professor	B. E., M .Tech, Ph.D.	Thermal Engineering, Solar Thermal Application, Passive heating & cooling, Refrigeration and Air Conditioning, Alternate Fuel of IC engine.
Prof. G. K. Sahu	Associate Professor	B. E., M .Tech	Fluid Mechanics
Dr. S Bhowmick	Associate Professor	B. E., M.E. Ph..D.	Structural Mechanics, Fluid Structure Interaction, Machine Design, Spectral and Finite Element Methods
Dr. S. K. Dewangan	Assistant Professor	B.Tech, M.Tech, Ph.D.	Multiphase flow, Experimental computational Fluid Dynamics, Rheology, Combustion Modelling
Dr. V. K. Gaba	Assistant Professor	B. E., M. E. Ph.D.	Heat Transfer, Refrigeration & Air Conditioning and Alternative Sources of Energy
Dr. N. Netam	Assistant Professor	B. E., M.Tech. Ph.D.	Thermal Engg, Heat & Mass Transfer, Two Phase Materials.

COURSE STRUCTURE/ SYLLABUS

SEMESTER- I

National Institute of Technology , Raipur (C.G.)													
M.Tech. in Mechanical Engineering with specialization in Thermal Engineering Started in 2010													
Course of Study & Scheme of Examination							M.Tech. *First* Semester					Branch: Mechanical	
S. No.	Board of Studies	*Course Code*	*Subject Name*	*Periods / week*			*Examination Scheme*					*Total Marks*	*Credits L+(T+P)/2*
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Mechanical	ME41111ME	**Advanced Numerical Techniques**	3	1	-	20	15	15	100	-	150	4
2	Mechanical	ME41112ME	**Advanced Thermodynamics**	3	1	-	20	15	15	100	-	150	4
3	Mechanical	ME41113ME	**Heat Transfer-I Conductive and Radiative Heat Transfer**	3	1	-	20	15	15	100	-	150	4
4	Mechanical	ME41115ME	**Refrigeration System Component Design**	3	1	-	20	15	15	100	-	150	4
5	Mechanical	ME41135ME	**Elective -I**	3	1	-	20	15	15	100	-	150	4
6	Mechanical	ME41126ME	**Lab - I Experiments on Heat Transfer**	-	-	3	75	-	-	-	50	125	2
7	Mechanical	ME41127ME	**Lab - II Experiments on Refrigeration Systems**	-	-	3	75	-	-	-	50	125	2
			Total	15	5	6	250	75	75	500	100	1000	24

Elective -I Advanced Finite Element Method/ Compressible Fluid Flow

SEMESTER -II

National Institute of Technology , Raipur (C.G.)													
M.Tech. in Mechanical Engineering with specialization in Thermal Engineering Started in 2010													
Course of Study & Scheme of Examination							MTech. *Second* Semester					Branch: Mechanical	
S. No.	Board of Studies	*Course Code*	*Subject Name*	*Periods / week*			*Examination Scheme*					*Total Marks*	*Credits L+(T+P)/2*
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Mechanical	ME41211ME	**Computational Fluid Dynamics**	3	1	-	20	15	15	100	-	150	4
2	Mechanical	ME41212ME	**Heat Transfer-II Convective Heat Transfer**	3	1	-	20	15	15	100	-	150	4
3	Mechanical	ME41213ME	**Advanced Fluid Mechanics**	3	1	-	20	15	15	100	-	150	4
4	Mechanical	ME41234ME	**Elective-II**	3	1	-	20	15	15	100	-	150	4
5	Mechanical	ME41245ME	**Elective-III**	3	1	-	20	15	15	100	-	150	4
6	Mechanical	ME41226ME	**Lab - I CFD**	-	-	3	75	-	-	-	50	125	2
7	Mechanical	ME41228ME	**Lab - II (Seminar) ***	-	-	3	75	-	-	-	50	125	2
			Total	15	5	6	250	75	75	500	100	1000	24

Elective 2- Design of Thermal Systems

Elective -3 Air Conditioning System Design

Elective -II Design of Thermal System
Elective -III Air Conditioning System Design

SEMESTER-III

National Institute of Technology , Raipur (C.G.)													
M. Tech. in Mechanical Engineering with specialization in Thermal Engineering Started in 2010													
Course of Study & Scheme of Examination								M. Tech. *Third* Semester				Branch: Mechanical	
S. No.	Board of Studies	*Course Code*	*Subject Name*	*Periods / week*			*Examination Scheme*					*Total Marks*	*Credits L+(T+P)/2*
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Mechanical		**Preliminary work on Dissertation**	-	-	24	100	-	-	-	200	300	12
2	Mechanical		**Comprehensive Viva Voce & Seminar**	-	-	-	-	-	-	-	200	200	4
			Total	0	0	24	100	0	0	0	400	500	16

SEMESTER-IV

National Institute of Technology , Raipur (C.G.)													
M. Tech. in Mecanical Engineering with specialization in Thermal Engineering Started in 2010													
Course of Study & Scheme of Examination								M. Tech. IV Semester				Branch: Mechanical	
S. No.	Board of Studies	*Course Code*	*Subject Name*	*Periods / week*			*Examination Scheme*					*Total Marks*	*Credits L+(T+P)/2*
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Mechanical		**Dissertation**	-	-	32	200	-	-	-	300	500	16
			Total	0	0	32	200	0	0	0	300	500	16

FOR SYLLABUS PLEASE SCAN THE QR CODE PROVIDED BELOW OR VISIT THE WEBSITE.

http://www.nitrr.ac.in/aboutmechanical1.php

SEMESTER - I

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Advanced Thermodynamics (Core)

COURSE OUTCOMES:

After studying this subject, Student will be able:

1. Understand the basic concept of thermodynamics.

2. Apply the basic understanding for getting the basic concepts of irreversible thermodynamics.

3. Study of properties of pure substances.

4. Understand the equation of state for real gases and appreciate its application in real situation.

5. Understand the thermodynamics behind chemical reactions

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Advanced Numerical Techniques (Core)

COURSE OUTCOMES:

After studying this subject, Student will be able to:

1. Formulate different type of errors and solve transcendental & algebraic equation by bracketing and open methods.
2. Develop curve fitting by least square and other methods and solve the problem through interpolation using Newton's forward ,backward & divide difference and by Lagrange's & gauss's method, which can be used for various real life numerical problem.
3. Solution of Numerical Differentiation & integration by Trapezoidal, Simpson and Newton cotes formula.
4. Numerical solution of ordinary differential equation by Euler's, modified Euler's, Runge Kutta methods and application to initial and boundary value problem.

5. Numerical solution of parabolic, elliptical an hyperbolic partial differential equation applied in various approximate solution.

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Heat Transfer – 1(Conductive & Radiative) (Core)

COURSE OUTCOMES:

After studying this subject, Student will be able to:

1. Understand the basic modes of heat transfer

2. Analysis of steady state situation in conduction for plane wall, cylinder and sphere.

9.

3. Study the transient (time dependent) conduction and solving problems of 1-d with explicit and implicit scheme.

4. Understand the basic of radiation.

5. Calculation of radiation exchange between black and grey body and concept of gas radiation.

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Refrigeration System Components Design (Core)

COURSE OUTCOMES:

At the end of this course the students will be able to:

1. Evaluate volumetric efficiency and power input of reciprocating compressors and also differentiate qualitatively the effects of evaporator and condenser temperatures, with understanding various methods of regulating its, their classification and lubrication.
2. Analyze the performance of a centrifugal compressor and evaluate required impeller diameter, speed and minimum refrigeration capacity with the understanding of surging.
3. Estimate condenser design parameters, optimum condenser pressure and effect of presence of non-condensable gases on its performance with understanding the comparison of air-cooled with water cooled condensers.
4. Estimate thermal design parameters of evaporators, and classify them with analyzing its salient features of different types of evaporators.
5. Estimate the required length of capillary tubes, analyse the practical problems encountered in the operation of various types of expansion devices.

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title:- Advanced Finite Element Method (Elective)

COURSE OUTCOMES:

At the end of this course the students will be able to :

1. Synthesise information and ideas for use in the evaluation process.
2. Develop governing equations of mechanical systems using domain knowledge and mathematical principles and apply principles of variation and integral forms of solution to formulate finite element problem.
3. Analyze and build FEA model for complex engineering problems.
4. Perceive the fundamental theory of the finite elements.
5. Develop skills to model the behaviour of structures under mechanical and thermo-mechanical loads.

LAB: EXPERIMENT ON HEAT TRANSFER

- To determine temperature distribution of a chimney using Agross 2-D software .
- To determine temperature distribution of a solid slab using Agross 2-D software .
- Analysis of fin by BVP4C using Matlab
- To determine the thermal conductivity of a poor material say asbestos sheet by hot guarded plates
- To determine the emissivity of grey surface.
- To study and analysis regenerative heat exchanger .
- To study of heat pipe .
- To find thermal conductivity of liquids.

LAB: EXPERIMENT IN AIR CONDITIONING SYSTEMS

- Study of Domestic Refrigeration Test rig
- Study of cold storage unit
- Study of multi expansion device & evaporator
- Automobile Air Conditioning
- Study of Ice plant tutor

SEMESTER-II

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Heat Transfer- II (Core)

COURSE OUTCOMES:

1. To understand the basic principle of convection and types of boundary layers.
2. To study the external forced convection over flat plate, cylinder and tubes and find correlations
3. To understand the phenomena of internal flow as in tubes and annular.
4. To understand the science behind natural convection and combined free and forced convection.
5. To design and analysis of different types of heat exchanger.

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Advance Fluid Mechanics (Core)

COURSE OUTCOMES:

After studying this subject, Student will be able to:

1. Understand the basics of Fluid kinematics and motion of fluid element.
2. Understand the integral relation for a control volume by applying conservation in mass, energy and momentum.
3. To understand the differential analysis of fluid flow and deals with Navier Stokes equation for various cases.
4. To find approximate solutions of Navier-Strokes equation.
5. To understand the concept of potential flow and its practical example

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Computational Fluid dynamics (Core)

COURSE OUTCOMES:

After studying this subject, Student will be able to:

1. Understand the basics of transport phenomenon and methods of discretization.
2. To solve general transport equation and study of steady diffusion and convection-diffusion problems.
3. To understand the Methods of flow field calculation by using different algorithms.
4. To know how to generate the numerical grids pertaining to various conditions.
5. To study the different types of methods to solve algebraic systems of equations

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Air Conditioning System Design (Elective)

COURSE OUTCOMES:

After studying this subject, Student will be able to:

1. Understand how to calculate solar radiation for horizontal, vertical and tilted surface.
2. Calculate solar radiation through fenestration, ventilation and infiltration and use it for design of solar appliances for buildings.
3. Calculate heating and cooling calculation, heat transfer through building.
4. Understand the different types of air conditioning system and its selection.
5. Understand the basics of transmission of air in air conditioning ducts.

Department of Mechanical Engineering
Programme: M. Tech. in Thermal Engineering
Course Title: Design of Thermal Systems (Elective)

COURSE OUTCOMES:

After studying this subject, Student will be able to:

1. Understand the basics steps in designing for thermal systems

2. To make model of thermal systems and study various types of model and interaction between them.

3. To generate numerical modelling for thermal systems and methods of simulation.

4. Economic analysis in the context of thermal system design.

5. Optimization techniques used in design.

LAB: CFD LAB

- Analysis of Flow in a Lid-Driven Cavity using FLUENT .
- CFD Analysis of Flow in an Intake Manifold .
- Analysis of Flow and Heat Transfer Over a Flat Plate .
- Simulation of Flow Development in a Pipe .
- Analysis of Flow Past a Circular Cylinder .
- In viscid & Compressible Flow through a Converging-Diverging Nozzle .
- Non-Newtonian Transition Flow in an Eccentric Annulus .