Certification Course on Cryogenic Engineering

Resource Person: Sri C. Naga Raja

Co-ordinator: Sri R. Mahesh

Date(s) of Event: 22/3/21 to 15/4/21

Organizing department: Mechanical Engineering

K.S.R.M.COLLEGEOFENGINEERING

(UGC-AUTONOMOUS)

Kadapa,Andhra Pradesh,India–516 005

ApprovedbyAICTE,NewDelhi&AffiliatedtoJNTUA,Ananthapuramu.

Cr./KSRMCE/(Department of ME)/2020-2021

Date: 15/03/2021

To

The Principal,

KSRM College of Engineering,

Kadapa.

Respected Sir

Sub: KSRMCE-(Department of ME) permission to conduct certification course on "**Cryogenic Engineering**"-Request-Reg.

It is brought to your kind notice that, with reference to the cited, the ME department is planning to conduct Certification Course on "**Cryogenic Engineering**" for B.Tech, VI Sem Students from **23 Mar, 2021 to 15 April ,2021**. In this regard I kindly request you to grant permission to conduct the certification course. This is submitted for your kind perusal.

Thanking you sir,

Forwarded to principal sir

Yours Faithfully

Sri R. Mahesh

Asst.Prof,Dept.ME

KSRMCE,Kadapa.

To the Director for Information

To All Deans/HoD's/IQAC

Permitted

V.S.S. Murthy

K.S.R.M.COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa,Andhra Pradesh,India–516 005

ApprovedbyAICTE,NewDelhi&AffiliatedtoJNTUA,Ananthapuramu

Cr./KSRMCE/(Department of ME)/2020-2021

Date: 15/03/2021

Circular

All the B.Tech VI Sem ME students are here by informed that department of MECHANICAL is going to conduct certificate course on "**Cryogenic Engineering**" interested students may register their names on or before 20-03-2021, 5 PM.

For any queries contact faculty coordinator:

Sri R. Mahesh, Asst.Prof, Dept.ME, KSRMCE, Kadapa.

Hod

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

K.S.R.M.COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India–516 005

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu

---

Department of Mechanical Engineering

Certification Course on **Cryogenic Engineering**

List of Participants

S.no	Roll No	Name of the Student	Email Id's
1	189Y1A0333	MUTUKUNDU SOMA SEKHAR REDDY	189Y1A0333@ksrmce.ac.in
2	189Y1A0334	NAGURU SAMPATH KUMAR	189Y1A0334@ksrmce.ac.in
3	189Y1A0335	NERSUPALLI SAI KUMAR REDDY	189Y1A0335@ksrmce.ac.in
4	189Y1A0336	NETURI SANDEEP KUMAR REDDY	189Y1A0336@ksrmce.ac.in
5	189Y1A0337	NUKANABOINA PULLAIAH	189Y1A0337@ksrmce.ac.in
6	189Y1A0338	PALTHURU BOJJAPPA	189Y1A0338@ksrmce.ac.in
7	189Y1A0339	PANDITI ANIL KUMAR	189Y1A0339@ksrmce.ac.in
8	189Y1A0340	PASUPURATHI RAJASEKHAR REDDY	189Y1A0340@ksrmce.ac.in
9	189Y1A0341	PATAN ASHRAF ALI KHAN	189Y1A0341@ksrmce.ac.in
10	189Y1A0342	PATAN SAMEER KHAN	189Y1A0342@ksrmce.ac.in
11	189Y1A0343	PATHAN ARBAAZ KHAN	189Y1A0343@ksrmce.ac.in
12	189Y1A0344	PATHAN NADEEM KHAN	189Y1A0344@ksrmce.ac.in
13	189Y1A0345	PEDDANAGGARI SIVAGIRINATH REDDY	189Y1A0345@ksrmce.ac.in
14	189Y1A0346	PERAM VARUN KUMAR REDDY	189Y1A0346@ksrmce.ac.in
15	189Y1A0347	POOJARI RAJKUMAR	189Y1A0347@ksrmce.ac.in
16	189Y1A0348	POTHUTEJESWARREDDY	189Y1A0348@ksrmce.ac.in
17	189Y1A0349	PRODDUTURU NAGA DASTAGIRI	189Y1A0349@ksrmce.ac.in
18	189Y1A0350	PULLAGURA SUNIL	189Y1A0350@ksrmce.ac.in
19	189Y1A0351	RACHAMREDDY CHARAN KUMAR REDDY	189Y1A0351@ksrmce.ac.in
20	189Y1A0352	SANKEPALLI SUNIL REDDY	189Y1A0352@ksrmce.ac.in
21	189Y1A0353	SARVADE YATHEESH RAO	189Y1A0353@ksrmce.ac.in

22	189Y1A0354	SHAIK ASIF	189Y1A0354@ksrmce.ac.in
23	189Y1A0355	SHAIK FAIZAAN HABEEB	189Y1A0355@ksrmce.ac.in
24	189Y1A0356	SHAIK GOUSE LAZAM	189Y1A0356@ksrmce.ac.in
25	189Y1A0357	SHAIK IMDAD VALLI	189Y1A0357@ksrmce.ac.in
26	189Y1A0358	SHAIK MAHAMMAD SHARIEF	189Y1A0358@ksrmce.ac.in
27	189Y1A0359	SHAIK MOHAMMAD TAYEEB	189Y1A0359@ksrmce.ac.in
28	189Y1A0360	SHAIK SHAJAHAN	189Y1A0360@ksrmce.ac.in
29	189Y1A0361	SHAIK VAYALPAD ABDUL KHAVI	189Y1A0361@ksrmce.ac.in
30	199Y5A0317	KONETI VENKATA SIVA MANORANJAN	199Y5A0317@ksrmce.ac.in
31	199Y5A0318	KOTHAPALLI PRUDHVI	199Y5A0318@ksrmce.ac.in
32	199Y5A0319	KURUVA BHASKAR	199Y5A0319@ksrmce.ac.in
33	199Y5A0320	KURUVA KUMAR	199Y5A0320@ksrmce.ac.in
34	199Y5A0321	MADDURU SAITEJA	199Y5A0321@ksrmce.ac.in
35	199Y5A0322	MAJJARI CHARAN	199Y5A0322@ksrmce.ac.in
36	199Y5A0324	MALISETTY LAKSHMINARASIMHA	199Y5A0324@ksrmce.ac.in
37	199Y5A0325	MALLELA RAJASHEKHAR REDDY	199Y5A0325@ksrmce.ac.in
38	199Y5A0326	MITAIABDULSHEIK MOHAMMED BASHA	199Y5A0326@ksrmce.ac.in
39	199Y5A0327	MOOLA ACHYUTH REDDY	199Y5A0327@ksrmce.ac.in
40	199Y5A0328	NADDI HARIKRISHNA	199Y5A0328@ksrmce.ac.in
41	199Y5A0329	NALLABALLE HARI OBULESU	199Y5A0329@ksrmce.ac.in
42	199Y5A0330	NANDYALA SISINDRI	199Y5A0330@ksrmce.ac.in
43	199Y5A0331	PICHIPATI SHAIK MAHAMMAD AFRID	199Y5A0331@ksrmce.ac.in
44	199Y5A0332	PUTTA SASIKANTH REDDY	199Y5A0332@ksrmce.ac.in
45	199Y5A0333	RAJULA ANAND REDDY	199Y5A0333@ksrmce.ac.in
46	199Y5A0334	SANNA GURAPPA	199Y5A0334@ksrmce.ac.in
47	199Y5A0335	SHAIK GHOUSE LAZAM	199Y5A0335@ksrmce.ac.in
48	199Y5A0336	SHAIK IMRAN	199Y5A0336@ksrmce.ac.in
49	199Y5A0337	SHAIK MAHABOOB BASHA	199Y5A0337@ksrmce.ac.in
50	199Y5A0338	SHAIK SHEKSHAVALI	199Y5A0338@ksrmce.ac.in
51	199Y5A0339	URUMU SUDHEER KUMAR	199Y5A0339@ksrmce.ac.in
52	199Y5A0340	VARIKUNTA MUNI DINESH PRAMOD	199Y5A0340@ksrmce.ac.in

		RAJU	
53	199Y5A0341	VENNAPUSA SREEKANTH REDDY	199Y5A0341@ksrmce.ac.in
54	199Y5A0342	VENNAPUSA UMESHCHANDRA REDDY	199Y5A0342@ksrmce.ac.in
55	199Y5A0343	YADAVAKUNTA SIVA RAMI REDDY	199Y5A0343@ksrmce.ac.in
56	199Y5A0344	YEDDULA GANGA PRASAD REDDY	199Y5A0344@ksrmce.ac.in
57	199Y5A0345	YEDDULA PRAVEEN KUMAR REDDY	199Y5A0345@ksrmce.ac.in
58	199Y5A0346	YERRAGORLA BRAMHAIAH	199Y5A0346@ksrmce.ac.in

Coordinator

HOD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

Syllabus

Cryogenic Engineering

COURSE OBJECTIVES

1. To relate the theory and practice for refrigeration and cryogenics.
2. To have a knowledge on cryogenic plants, its safety and maintenance.

Unit-1: Introduction to cryogenic refrigeration systems: Review of basic thermodynamics, liquefaction systems, ideal, Cascade, Linde - Hampson and Claude cycles.

Unit-2: Gas separation and gas purification systems: Thermodynamic ideal separation system, Properties of mixtures, principles of gas separation, Linde single column air separation, Linde double column air separation.

Unit-3: Properties of materials at low temperature: Specific heat, thermal conductivity, electrical conductivity, magnetic and mechanical properties of materials at low temperature

Unit-4: Cryogenic Insulations: Heat Transfer due to conduction, evacuated porous insulation Powder &Fiberspacified powder insulation

Unit-5: Cryogenic fluid storage and transfer systems: Design of cryogenic fluid storage vessels, Inner vessel, Outer Insulation, Suspension system.
Applications of cryogenic systems: Cryogenic application for food preservation – Instant Quick-Freezing Techniques, Super conductive devices, Cryogenic applications for space technology. Application of cryogenic systems, super conducting devices, space technology, nuclear technology, cryogenics in biology and medicine.

COURSE OUTCOMES

1. To create practical engineers for operation of the plant
2. Able to operate the plant and maintenance of equipment

Textbooks:

1. K. D. Timmerhaus and T. M. Flynn, *Cryogenic Process Engineering,* 1st Edition, 1989Springer, New York, US.
2. Randall F. Barron, *Cryogenics Systems*, 2nd Edition, 1985, Oxford University Press, New York, US.

References:

1. Graham Walker, *Cryocooler- Part 1: Fundamentals*, 1983, Springer, New York, US
2. Marshall Sittig& Stephen Kidd, *Cryogenics: research and applications*, 1963, Van Nostrand Reinhold Inc., U.S.

UNIT-4

Plan and optimize programs for CNC turning operations. Calculate parameters like speed feed etc. and set references for the various operations. Prepare operation and operation sequence for the lathe operations like turning, grooving etc. Prepare & set CNC lathe operations and test run programmed.

UNIT-5.

Plan and optimize programs for CNC Milling operations. Calculate parameters like speed feed , depth of cut etc. set a references for the various operations. Various methods of work process like edge finding block center etc. Prepare & set CNC Milling operations and test run programmed

Learning Outcomes

- Explain applications and advantages of CNC machines and technology
- Demonstrate and explain various CNC control Calculate technological data for CNC machining
- Understand the importance and use of PPE's
- Prepare and understand line program for various profiles Identify and set parameters for various simulators
- Prepare programs , demonstrate , simulate and operate CNC lathe machines for various machining operations
- Prepare programs , demonstrate , simulate and operate CNC milling machines for various machining operations
- Define and explain Modern CNC systems and explain its importance in manufacturing

TEXT BOOKS:

1. CNC Programming skills ; Program Entry ane Editing on Fanuc Machines**By S.K Sinha**
2. Easy CNC Programming hand book: HMC , VMC, MULTI AXIS**Sanjay Sharma**
3. CNC Programming For Lathe &Milling : Siemens sinumerik Control**HarshalDhawas.**

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

K.S.R.M.COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa,Andhra Pradesh,India–516 005

ApprovedbyAICTE,NewDelhi&AffiliatedtoJNTUA,Ananthapuramu

Department of Electrical and Electronics Engineering

Certification Course on Cryogenic Engineering

Schedule

Timing: 4:00pm – 6:00pm

S.No	Date	Course Coordinator	Topic Covered
1	22-03-2021	Sri C. Naga Raja	Introduction to cryogenic refrigeration systems: Review of basic thermodynamics
2	23-03-2021	Sri R. Mahesh	liquefaction systems, ideal, Cascade, Linde - Hampson and Claude cycles.
3	24-03-2021	Sri R. Mahesh	Gas separation and gas purification systems: Thermodynamic ideal separation system
4	25-03-2021	Sri C. Naga Raja	Properties of mixtures, principles of gas separation,
5	26-03-2021	Sri R. Mahesh	Linde single column air separation
6	27-03-2021	Sri C. Naga Raja	Thermodynamic ideal separation system, Properties of mixtures, principles of gas separation
7	29-03-2021	Sri R. Mahesh	**Specific heat, thermal conductivity, electrical conductivity**
8	30-03-2021	Sri C. Naga Raja	**Magnetic and mechanical properties of materials at low temperature**
9	02-04-2021	Sri R. Mahesh	Linde - Hampson and Claude cycles.
10	04-04-2021	Sri C.Naga Raja	Heat Transfer due to conduction
11	06-04-2021	Sri R. Mahesh	evacuated porous insulation Powder
12	08-04-2021	Sri C. Naga Raja	Fibers Opacified powder insulation
13	10-04-2021	Sri R. Mahesh	Cryogenic fluid storage and transfer systems: Design of cryogenic fluid storage vessels
14	12-04-2021	Sri C. Naga Raja	Cryogenic application for food preservation – Instant Quick-Freezing Techniques, Super conductive devices
15	15-04-2021	Sri R. Mahesh	Application of cryogenic systems, super conducting devices, space technology, nuclear technology,

Coordinator

HoD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

K.S.R.M.COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India–516 005
Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu

---

Department of Mechanical Engineering

Activity Report

Name of the Event	: Certification Course on **Cryogenic Engineering**
Date of the Event	: 22/3/21 to 15/4/21
Scheduled Time	: 4.00 to 6.00PM
Target Audience	: B.Tech VI Sem Students
Course co-ordinator	: R. Mahesh

Activity Description:

Cryogenic Engineering is one of the Advanced subject for Mechanical students, the ,Department of Mechanical organized a certification course on "**Cryogenic Engineering**". Head of the Department, faculty & participants inaugurated with all good spirit. Resource persons began with the Introduction to **Cryogenic Engineering** followed by cryogenic refrigeration systems, finally valedictory. Students were issued participation certificates by the Head of the Department.

Coordinator

HOD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

K.S.R.M. COLLEGE OF ENGINEERING

UGC - Autonomous

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.
Kadapa, Andhra Pradesh, India– 516 003

Certificate Course on

Cryogenic Engineering

22/03/2021 to 15/04/2021

Organized by

DEPARTMENT OF MECHANICAL ENGINEERING

K.S.R.M.COLLEGEOF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India–516 005

Approved by AICTE, NewDelhi & Affiliated to JNTUA, Ananthapuramu.

Department of Mechanical Engineering

Certification Course on **Cryogenic Engineering**

Attendance Sheet

S.No	Name of the Student	Roll List	22 Mar	23	24	25	26	27	29	30	02	04	06	08	10	12	15 Apr
1	MUTUKUNDU SOMA SEKHAR REDDY	189Y1A0333	✓	✓	A	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	NAGURU SAMPATH KUMAR	189Y1A0334	A	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	A	✓	✓
3	NERSUPALLI SAI KUMAR REDDY	189Y1A0335	✓	✓	A	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	NETURI SANDEEP KUMAR REDDY	189Y1A0336	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓
5	NUKANABOINA PULLAIAH	189Y1A0337	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	A
6	PALTHURU BOJJAPPA	189Y1A0338	✓	A	✓	A	✓	✓	A	✓	✓	✓	✓	A	✓	A	✓
7	PANDITI ANIL KUMAR	189Y1A0339	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	PASUPURATHI RAJASEKHAR REDDY	189Y1A0340	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	PATAN ASHRAF ALI KHAN	189Y1A0341	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓
10	PATAN SAMEER KHAN	189Y1A0342	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	PATHAN ARBAAZ KHAN	189Y1A0343	✓	✓	✓	✓	✓	A	✓	✓	✓	A	✓	✓	✓	✓	✓
12	PATHAN NADEEM KHAN	189Y1A0344	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	A	✓
13	PEDDANAGGARI SIVAGIRINATH REDDY	189Y1A0345	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓
14	PERAM VARUN KUMAR REDDY	189Y1A0346	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15	POOJARI RAJKUMAR	189Y1A0347	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
16	POTHUTEJESWARREDDY	189Y1A0348	A	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	A	A	✓	✓
17	PRODDUTURU NAGA DASTAGIRI	189Y1A0349	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
18	PULLAGURA SUNIL	189Y1A0350	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19	RACHAMREDDY CHARAN KUMAR	189Y1A0351	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

	REDDY																	
20	SANKEPALLI SUNIL REDDY	189Y1A0352	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
21	SARVADE YATHEESH RAO	189Y1A0353	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
22	SHAIK ASIF	189Y1A0354	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
23	SHAIK FAIZAAN HABEEB	189Y1A0355	✓	✓	A	✓	✓	✓	A	✓	A	✓	✓	✓	✓	A	✓	✓
24	SHAIK GOUSE LAZAM	189Y1A0356	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
25	SHAIK IMDAD VALLI	189Y1A0357	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	
26	SHAIK MAHAMMAD SHARIEF	189Y1A0358	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	A	✓	
27	SHAIK MOHAMMAD TAYEEB	189Y1A0359	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
28	SHAIK SHAJAHAN	189Y1A0360	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	
29	SHAIK VAYALPAD ABDUL KHAVI	189Y1A0361	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓
30	KONETI VENKATA SIVA MANORANJAN	199Y5A0317	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓
31	KOTHAPALLI PRUDHVI	199Y5A0318	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓
32	KURUVA BHASKAR	199Y5A0319	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
33	KURUVA KUMAR	199Y5A0320	✓	✓	✓	✓	✓	✓	A	✓	✓	A	✓	✓	✓	✓	✓	✓
34	MADDURU SAITEJA	199Y5A0321	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
35	MAJJARI CHARAN	199Y5A0322	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
36	MALISETTY LAKSHMINARASIMHA	199Y5A0324	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
37	MALLELA RAJASHEKHAR REDDY	199Y5A0325	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓
38	MITAIABDULSHEIK MOHAMMED BASHA	199Y5A0326	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
39	MOOLA ACHYUTH REDDY	199Y5A0327	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
40	NADDI HARIKRISHNA	199Y5A0328	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
41	NALLABALLE HARI OBULESU	199Y5A0329	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
42	NANDYALA SISINDRI	199Y5A0330	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓
43	PICHIPATI SHAIK MAHAMMAD AFRID	199Y5A0331	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
44	PUTTA SASIKANTH REDDY	199Y5A0332	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
45	RAJULA ANAND REDDY	199Y5A0333	✓	A	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
46	SANNA GURAPPA	199Y5A0334	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
47	SHAIK GHOUSE LAZAM	199Y5A0335	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓
48	SHAIK IMRAN	199Y5A0336	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
49	SHAIK MAHABOOB BASHA	199Y5A0337	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
50	SHAIK SHEKSHAVALI	199Y5A0338	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
51	URUMU SUDHEER KUMAR	199Y5A0339	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

52	VARIKUNTA MUNI DINESH PRAMOD RAJU	199Y5A0340	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	A	✓	✓	✓
53	VENNAPUSA SREEKANTH REDDY	199Y5A0341	✓	✓	A	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓
54	VENNAPUSA UMESHCHANDRA REDDY	199Y5A0342	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	A
55	YADAVAKUNTA SIVA RAMI REDDY	199Y5A0343	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
56	YEDDULA GANGA PRASAD REDDY	199Y5A0344	✓	✓	✓	A	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓
57	YEDDULA PRAVEEN KUMAR REDDY	199Y5A0345	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
58	YERRAGORLA BRAMHAIAH	199Y5A0346	A	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Coordinator

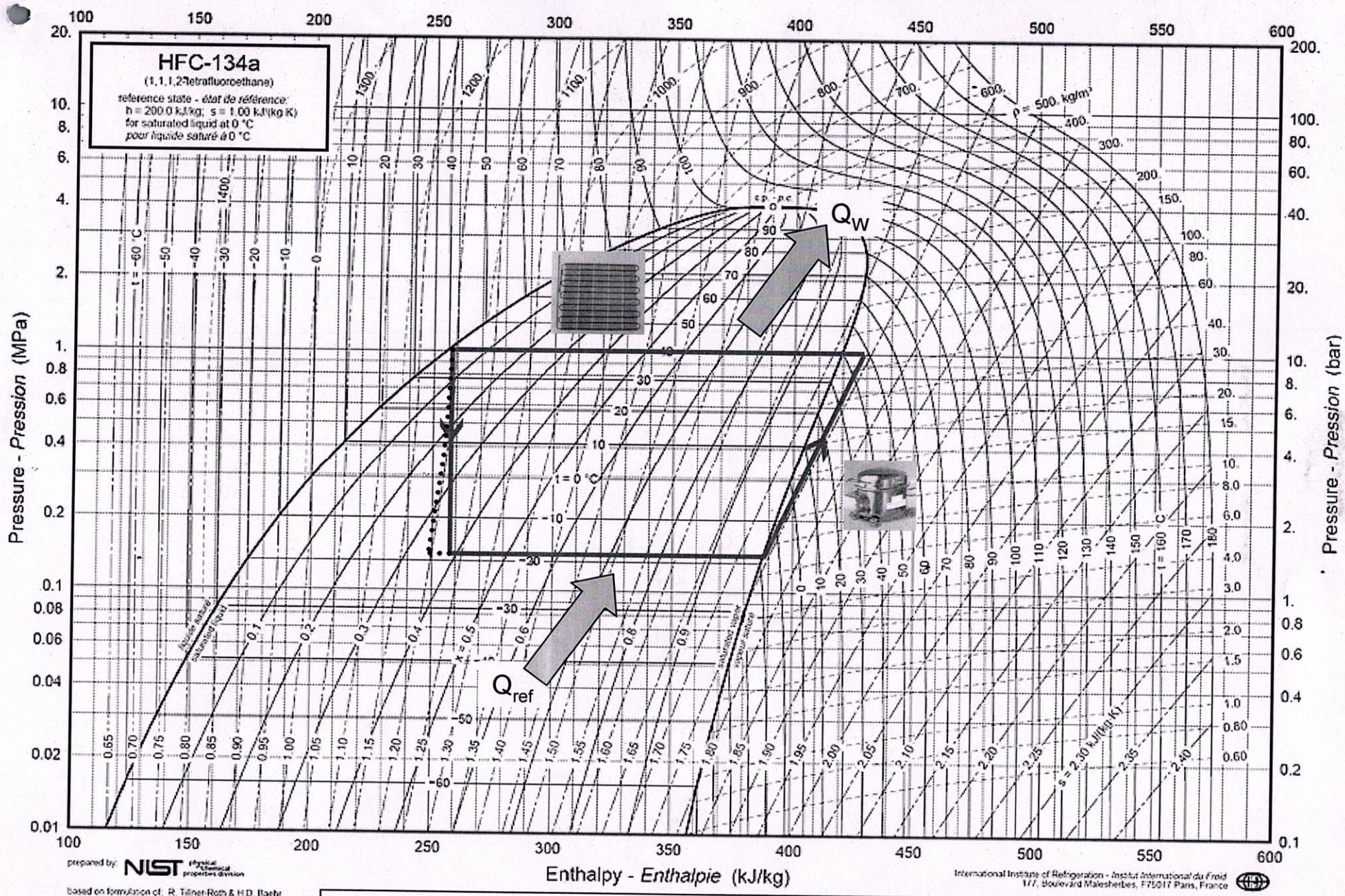
HOD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.

Refrigeration cycles/principles

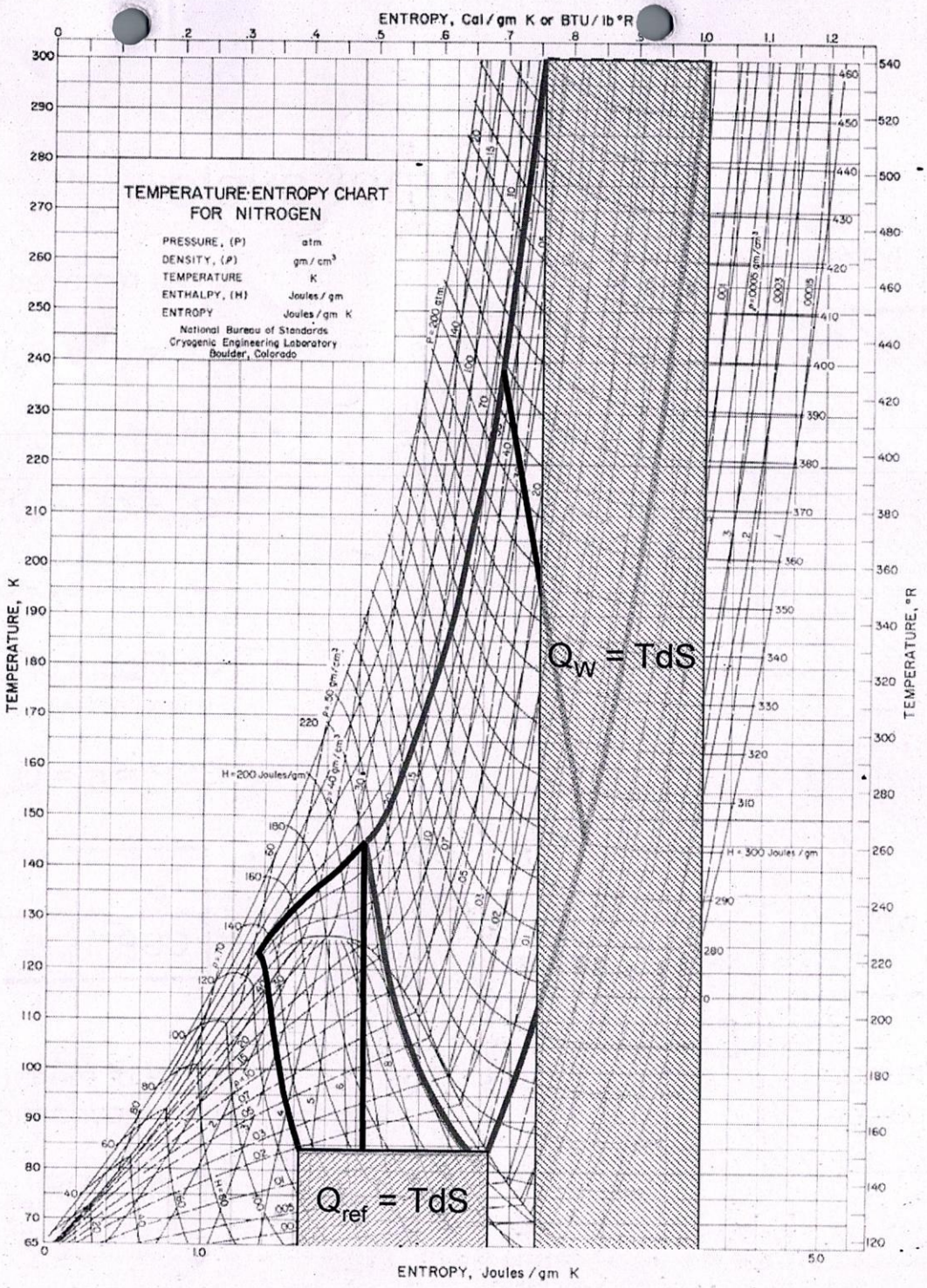
	without heat recovery	with recuperator	with regenerator
throttling	cascade sorption	Joule – Thomson Linde – Hampson dilution	
expansion	Ranque Hilsch	Claude Brayton Collins	Stirling Solvay Vuilleumier Gifford – McMahon pulse tube
other principles	thermoelectric (cascade)	magnetic	

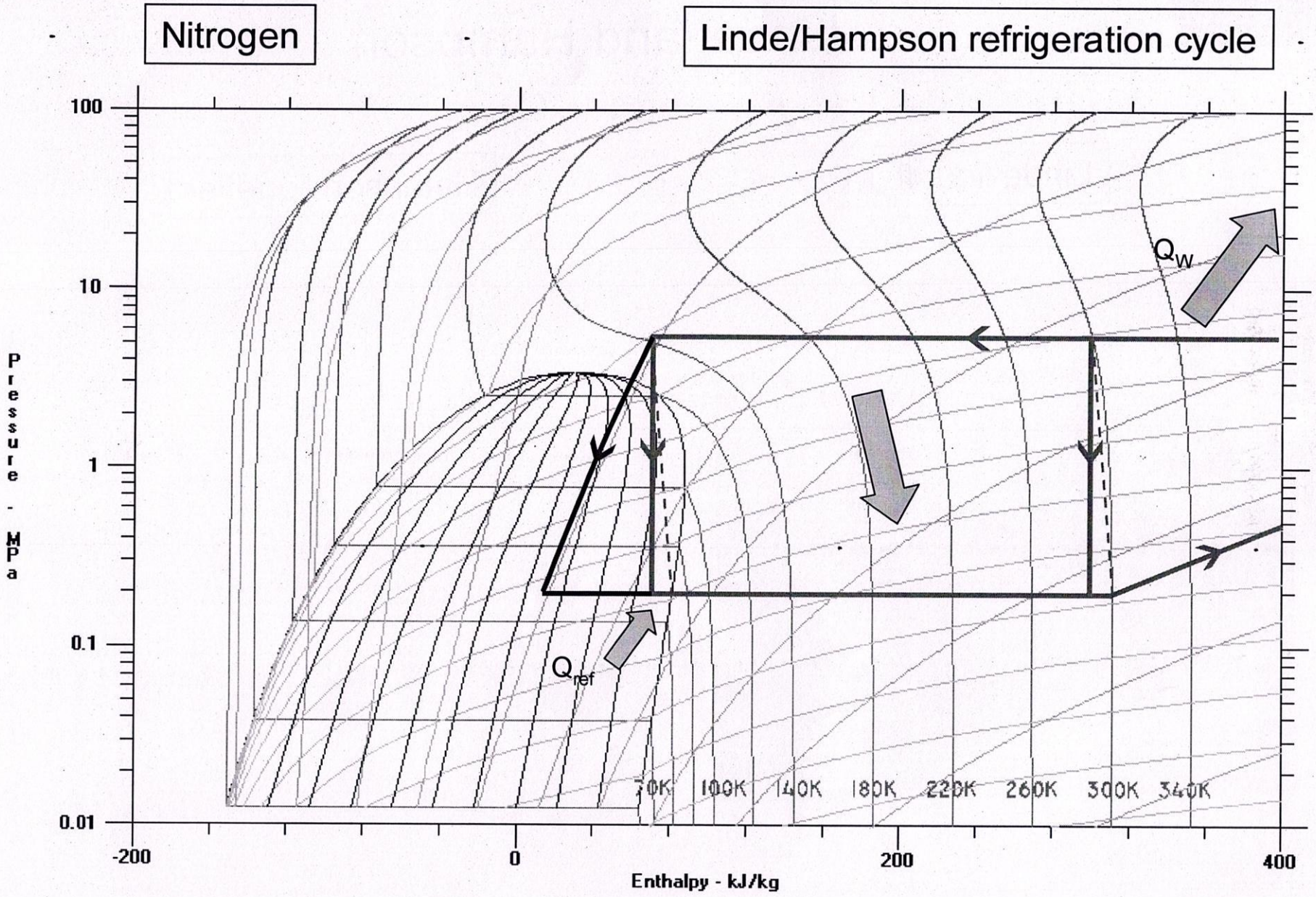
Cycles

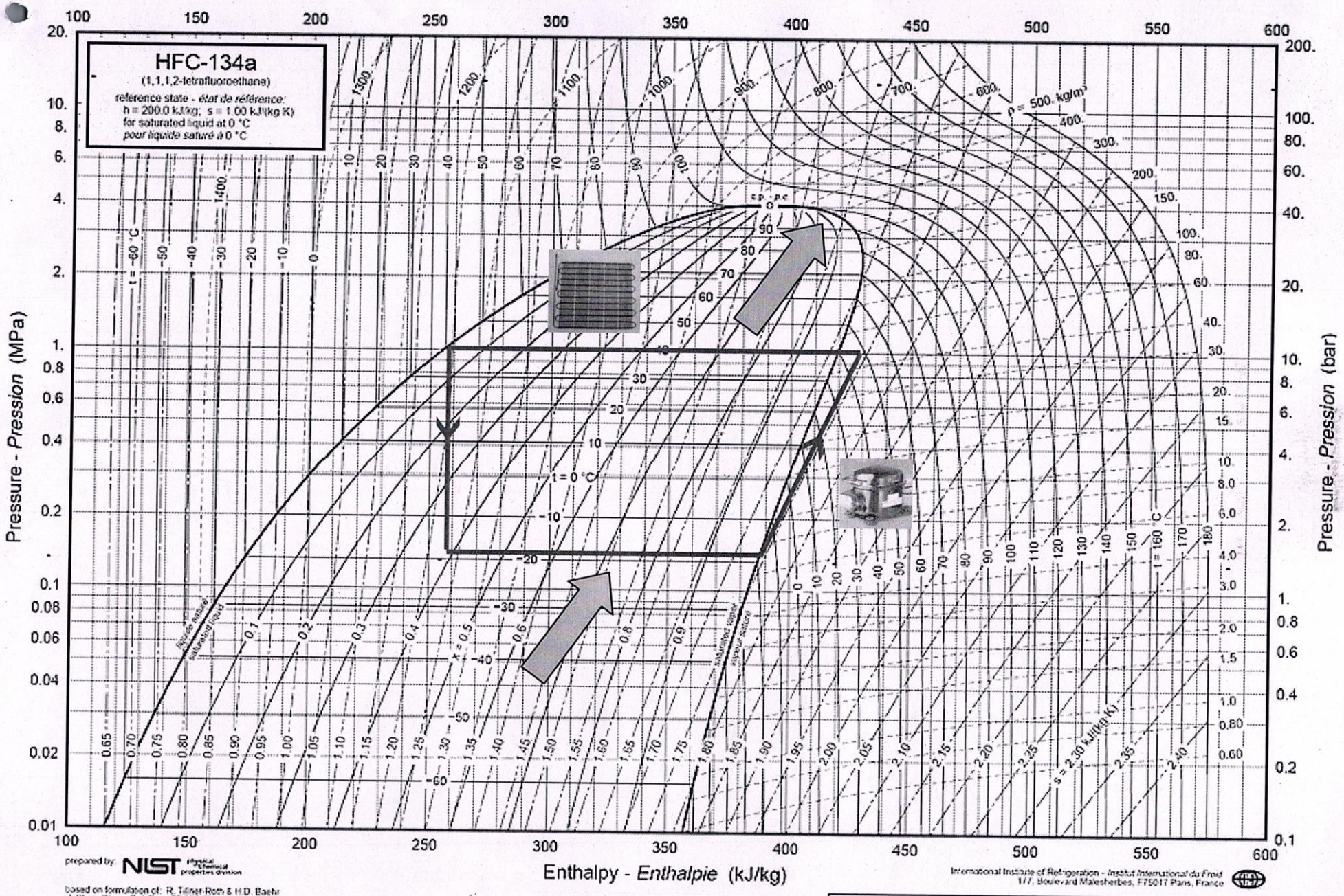


no gain with expansion machine in household refrigerator

Claude refrigeration cycle

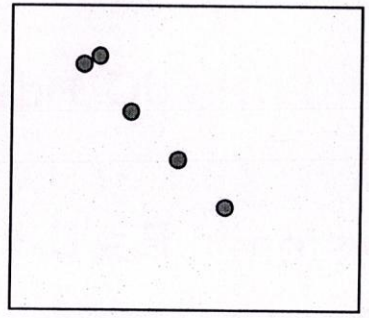


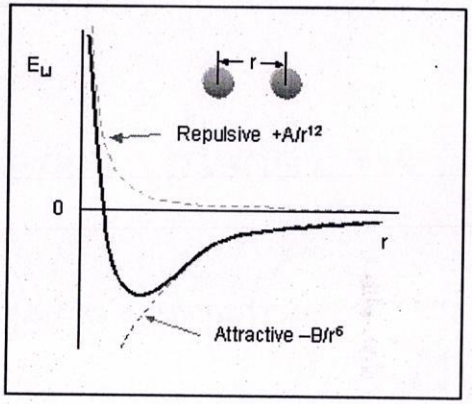

Nitrogen
Linde/Hampson refrigeration cycle
100
10
1
0.1
0.01
Pressure - MPa
-200
0
200
400
Enthalpy - kJ/kg
Q_W
Q_{ref}
70K
100K
140K
180K
220K
260K
300K
340K



Household refrigerator cycle

The magic of throttling - physicist's explanation





T ↗

repulsion dominates (Coulomb)
→

T →

ideal gas

Gay-Lussac

T ↘

attraction dominates (gravity)
Joule-Thompson

Thermo-dynamics

Braking the cryo-barrier II

R. Pictet
1832 - 1913

- Pictet's apparatus
  - production of oxygen under pressure in a retort
  - two pre-cooling refrigeration cycles:

    first stage SO_2 (-10°C)
    second stage CO_2 (-78°C)
  - oxygen flow is pre-cooled by the means of heat exchangers and expands to atmosphere via a hand valve

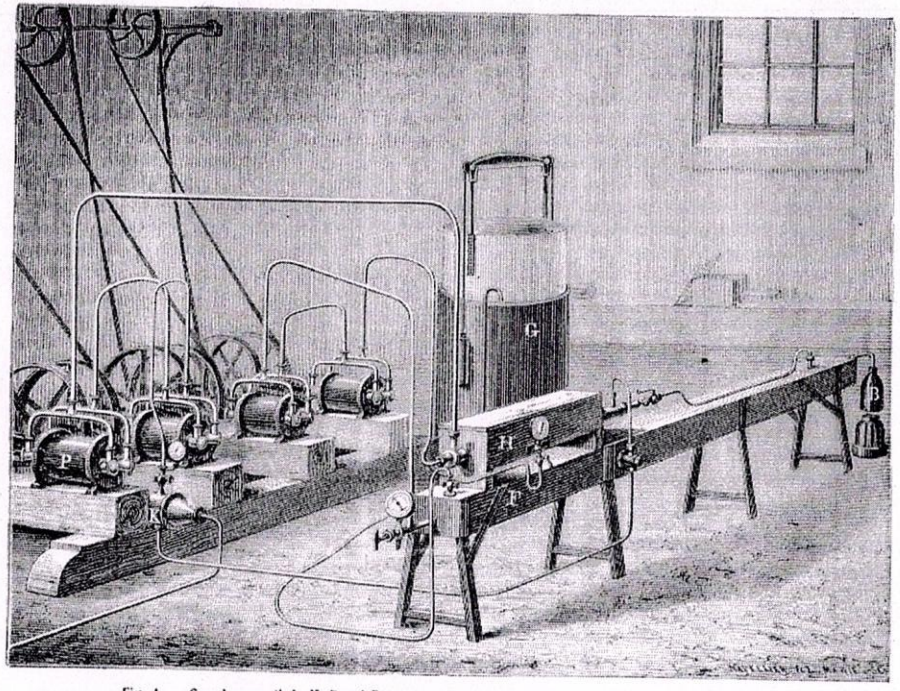
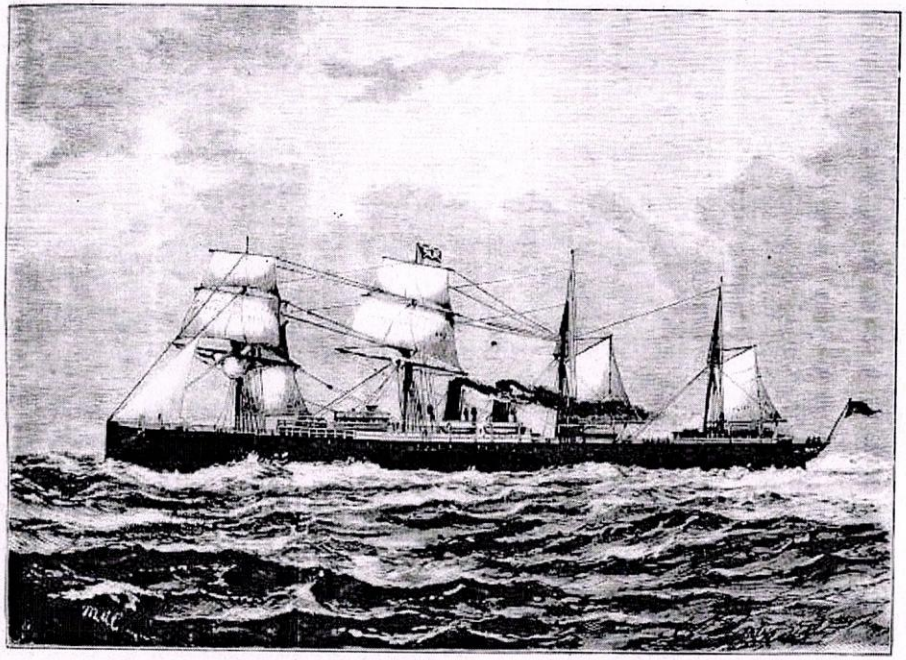


Fig. 1. — Grand appareil de M. Raoul Pictet pour la liquéfaction des gaz. (D'après une photographie.)

Incentives for refrigeration and cryogenics

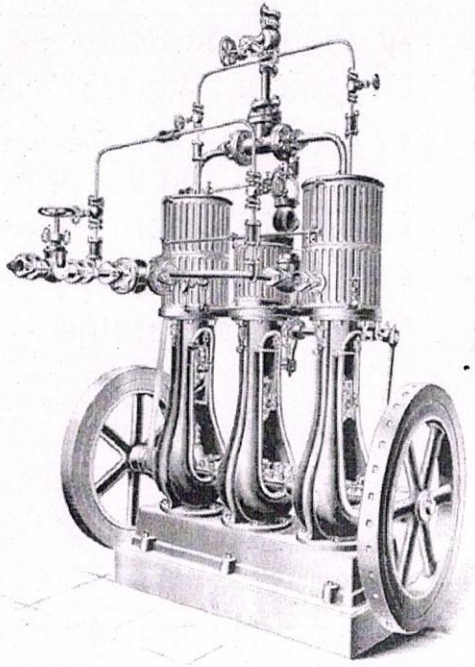
- Examples of first commercial refrigeration applications



THE ORIENT COMPANY'S NEW STEAMSHIP ORIENT

S.S. Strathleven, equipped with Bell&Coleman air-cycle refrigerator. First meat cargo transported from Australia to London 6.12.1879 - 2.2.1880.

By courtesy of "La Trobe Picture Collection", State Library of Victoria



No. 0. 2 TO 3 TON ICE MACHINE

Standard ammonia cycle ice machine from York's 1892 catalogue.

Further development of thermodynamics

- J. Black (1728 - 1799) latent heat
- A. Lavoisier (1743 - 1794) caloric theory
- S. Carnot (1824) work
- R. Clausius (1865) entropy
- W. Gibbs (1867); R. Mollier (1923) enthalpy

K.S.R.M. COLLEGE OF ENGINEERING

UGC - AUTONOMOUS
KADAPA , AP – 516 005

Certificate of Completion

This is to certify that

Mr/Ms. P. SAMEER KHAN

Bearing the Roll No 18971A0342

has Succesfully completed certification course on

CRYOGENIC ENGINEERING

From 22/3/21 *to* 15/4/21 *, Organized by Department of*

MECHANICAL ENGINEERING

Coordinator	Head Of Department	Principal

K.S.R.M. COLLEGE OF ENGINEERING

UGC - AUTONOMOUS
KADAPA , AP – 516 005

Certificate of Completion

This is to certify that

Mr/Ms. M.ACHYUTH REDDY

Bearing the Roll No 199Y5A0327

has Succesfully completed certification course on

CRYOGENIC ENGINEERING

From 22/3/21 *to* 15/4/21 *, Organized by Department of*

MECHANICAL ENGINEERING

Coordinator | Head Of Department | Principal

K.S.R.M. COLLEGE OF ENGINEERING

UGC - AUTONOMOUS
KADAPA , AP – 516 005

Certificate of Completion

This is to certify that

Mr/Ms. SHAIK IMRAN

Bearing the Roll No 199SA0336

has Succesfully completed certification course on

CRYOGENIC ENGINEERING

From 22/3/21 ***to*** 15/4/21 ***, Organized by Department of***

MECHANICAL ENGINEERING

Coordinator | Head Of Department | Principal

K.S.R.M. COLLEGE OF ENGINEERING
(UGC-AUTONOMOUS)
Kadapa,Andhra Pradesh,India–516 005
ApprovedbyAICTE,NewDelhi&AffiliatedtoJNTUA,Ananthapuramu.

Department of Mechanical Engineering
Certification Course on Cryogenic Engineering

S.No	Name of the Student	Roll List	Is the Course content meet your expectation	Is the lecture sequence well planned	Is the level of course high	Is the course exposed you to the new knowledge and practices	Rate the Knowledge of the Speaker	Rate the value of Course in increasing your skills	Any Issues
1	MUTUKUNDU SOMA SEKHAR REDDY	189Y1A0333	yes	Agree	Strongly Ag	Yes	4	5	Nil
2	NAGURU SAMPATH KUMAR	189Y1A0334	yes	Agree	Agree	Yes	5	5	Need extra Explanation
3	NERSUPALLI SAI KUMAR REDDY	189Y1A0335	yes	Agree	Agree	Yes	4	5	Nil
4	NETURI SANDEEP KUMAR REDDY	189Y1A0336	yes	Agree	Agree	Yes	5	5	Nil
5	NUKANABOINA PULLAIAH	189Y1A0337	yes	Agree	Agree	Yes	5	5	Provide PPT
6	PALTHURU BOJJAPPA	189Y1A0338	yes	Agree	Agree	Yes	5	4	Nil
7	PANDITI ANIL KUMAR	189Y1A0339	yes	Agree	Agree	Yes	5	4	Nil
8	PASUPURATHI RAJASEKHAR REDDY	189Y1A0340	yes	Agree	Agree	Yes	4	5	Nil
9	PATAN ASHRAF ALI KHAN	189Y1A0341	yes	Agree	Agree	Yes	5	5	Nil
10	PATAN SAMEER KHAN	189Y1A0342	yes	Agree	Agree	Yes	5	5	Nil
11	PATHAN ARBAAZ KHAN	189Y1A0343	yes	Agree	Agree	Yes	5	5	Nil
12	PATHAN NADEEM KHAN	189Y1A0344	yes	Agree	Agree	Yes	5	5	Nil
13	PEDDANAGGARI SIVAGIRINATH REDDY	189Y1A0345	yes	Agree	Agree	Yes	5	5	Nil
14	PERAM VARUN KUMAR REDDY	189Y1A0346	yes	Agree	Agree	Yes	5	5	Nil
15	POOJARI RAJKUMAR	189Y1A0347	yes	Agree	Agree	Yes	5	5	Nil
16	POTHUTEJESWARREDDY	189Y1A0348	yes	Agree	Agree	Yes	5	5	Nil
17	PRODDUTURU NAGA DASTAGIRI	189Y1A0349	yes	Agree	Agree	Yes	5	5	Nil
18	PULLAGURA SUNIL	189Y1A0350	yes	Agree	Agree	Yes	4	5	Nil
19	RACHAMREDDY CHARAN KUMAR REDDY	189Y1A0351	yes	Agree	Agree	Yes	5	5	Nil

20	SANKEPALLI SUNIL REDDY	189Y1A0352	yes	Agree	Agree	Yes	5	5	Nil
21	SARVADE YATHEESH RAO	189Y1A0353	yes	Agree	Agree	Yes	5	5	Nil
22	SHAIK ASIF	189Y1A0354	yes	Agree	Agree	Yes	5	5	Nil
23	SHAIK FAIZAAN HABEEB	189Y1A0355	yes	Agree	Agree	Yes		5	Nil
24	SHAIK GOUSE LAZAM	189Y1A0356	yes	Agree	Agree	Yes	5	5	Nil
25	SHAIK IMDAD VALLI	189Y1A0357	yes	Agree	Agree	Yes	5	5	Nil
26	SHAIK MAHAMMAD SHARIEF	189Y1A0358	yes	Agree	Agree	Yes	5	5	Nil
27	SHAIK MOHAMMAD TAYEEB	189Y1A0359	yes	Agree	Agree	Yes	5	5	Nil
28	SHAIK SHAJAHAN	189Y1A0360	yes	Agree	Agree	Yes		5	Nil
29	SHAIK VAYALPAD ABDUL KHAVI	189Y1A0361	yes	Agree	Agree	Yes	5	5	Nil
30	KONETI VENKATA SIVA MANORANJAN	199Y5A0317	yes	Agree	Agree	Yes	5	5	Nil
31	KOTHAPALLI PRUDHVI	199Y5A0318	yes	Agree	Agree	Yes	5	5	Nil
32	KURUVA BHASKAR	199Y5A0319	yes	Agree	Agree	Yes	5	5	Nil
33	KURUVA KUMAR	199Y5A0320	yes	Agree	Agree	Yes	4	5	Nil
34	MADDURU SAITEJA	199Y5A0321	yes	Agree	Agree	Yes	5	5	Nil
35	MAJJARI CHARAN	199Y5A0322	yes	Agree	Agree	Yes	5	5	Nil
36	MALISETTY LAKSHMINARASIMHA	199Y5A0324	yes	Agree	Agree	Yes	5	5	Nil
37	MALLELA RAJASHEKHAR REDDY	199Y5A0325	yes	Agree	Agree	Yes	5	5	Nil
38	MITAIABDULSHEIK MOHAMMED BASHA	199Y5A0326	yes	Agree	Agree	Yes	4	5	Nil
39	MOOLA ACHYUTH REDDY	199Y5A0327	yes	Agree	Agree	Yes	5	5	Nil
40	NADDI HARIKRISHNA	199Y5A0328	yes	Agree	Agree	Yes	5	5	Nil
41	NALLABALLE HARI OBULESU	199Y5A0329	yes	Agree	Agree	Yes	5	5	Nil
42	NANDYALA SISINDRI	199Y5A0330	yes	Agree	Agree	Yes	5	5	Nil
43	PICHIPATI SHAIK MAHAMMAD AFRID	199Y5A0331	yes	Agree	Agree	Yes	4	5	Nil
44	PUTTA SASIKANTH REDDY	199Y5A0332	yes	Agree	Agree	Yes	5	5	Nil
45	RAJULA ANAND REDDY	199Y5A0333	yes	Agree	Agree	Yes	5	5	Nil
46	SANNA GURAPPA	199Y5A0334	yes	Agree	Agree	Yes	5	5	Nil
47	SHAIK GHOUSE LAZAM	199Y5A0335	yes	Agree	Agree	Yes	5	5	Nil
48	SHAIK IMRAN	199Y5A0336	yes	Agree	Agree	Yes	4	5	Nil
49	SHAIK MAHABOOB BASHA	199Y5A0337	yes	Agree	Agree	Yes	5	5	Nil
50	SHAIK SHEKSHAVALI	199Y5A0338	yes	Agree	Agree	Yes	5	5	Nil
51	URUMU SUDHEER KUMAR	199Y5A0339	yes	Agree	Agree	Yes	5	5	Nil
52	VARIKUNTA MUNI DINESH PRAMOD RAJU	199Y5A0340	yes	Agree	Agree	Yes	5	5	Nil
53	VENNAPUSA SREEKANTH REDDY	199Y5A0341	yes	Agree	Agree	Yes	5	5	Nil

54	VENNAPUSA UMESHCHANDRA REDDY	199[illegible]A0342	yes	Agree	Agree	Yes	4	5	Nil
55	YADAVAKUNTA SIVA RAMI REDDY	199Y5A0343	yes	Agree	Agree	Yes	5	5	Nil
56	YEDDULA GANGA PRASAD REDDY	199Y5A0344	yes	Agree	Agree	Yes	5	5	Nil
57	YEDDULA PRAVEEN KUMAR REDDY	199Y5A0345	yes	Agree	Agree	Yes	5	5	Nil
58	YERRAGORLA BRAMHAIAH	199Y5A0346	yes	Agree	Agree	Yes	5	5	Nil

Coordinator

HOD

Professor & Head
Department of Mechnical Engineering
K.S.R.M. College of Engineering
KADAPA - 516 003.