



SYLLABUS

SCHOOL OF ENGINEERING

SYLLABUS

FOR

**PROGRAM: B.TECH.**  
**[MECHANICAL ENGINEERING]**

ACADEMIC YEAR: 2017 – 18  
(BATCH: 2014-2018)

SEMESTER: VII

DIRECTOR  
SCHOOL OF ENGINEERING  
RK UNIVERSITY  
RAJKOT

## TEACHING SCHEME

**PROGRAM:**

B.TECH. [ MECHANICAL ENGINEERING ]

**SEMESTER**

VII

**ACADEMIC YEAR: 2017-18**

**[2014-18 BATCH]**

### Sem-VII

Course Code	Course Name	Teaching Scheme (Hours)			Credits
		Theory	Tutorials	Practicals	
ME706	REFRIGERATION AND AIR-CONDITIONING	3	0	2	4
ME707	AUTOMOBILE ENGINEERING	3	0	2	4
ME708	COMPUTER INTEGRATED MANUFACTURING	3	0	2	4
ME709	PRODUCTION TECHNOLOGY	3	0	2	4
ME710	DESIGN OF HEAT EXCHANGE EQUIPMENTS	3	0	2	4
ME711	CAPSTON DESIGN - I	0	0	(2)	5
ME7XX	ELECTIVE – I	3	0	2	4
PC701	INDUSTRIAL INTERNSHIP	0	0	0	5
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>12</b>	<b>34</b>
	<b>Total Hours</b>	<b>30</b>			

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<b>Course Title</b>	<b>REFRIGERATION AND AIR-CONDITIONING</b>
<b>Course Code</b>	<b>ME706</b>
<b>Course Credit</b>	Theory :03
	Practical :01
	Tutorial :00
	Credits :04

**Course Learning Outcomes:**

After Successful completion of the above course, students will be able to:

- **Identify** the components of refrigeration systems and **describe** their functioning.
- **Indicate** the refrigeration process on P-h and T-S diagrams.
- Use diagrams of thermodynamic processes and properties to **solve** refrigeration design problems.
- **Analyze** the refrigeration cycle and **calculate** the COP of the system.
- **Distinguish** performance of different refrigerants according to application.

**Detailed Syllabus**

<b>Sr. No.</b>	<b>Name of chapter &amp; details</b>	<b>Hours Allotted</b>
<b>SECTION-I</b>		
<b>1</b>	<b>Introduction:</b> Recapitulation of Thermodynamics, Thermodynamics process pertaining to refrigeration and air conditioning. First and Second law applied to refrigerating machines, Carnot principles, Unit of refrigeration, COP.	<b>03</b>
<b>2</b>	<b>Air Refrigeration:</b> Air refrigeration cycle. Reverse Carnot cycle, Bell-Coleman cycle, Numerical on above cycles. <b>Air Refrigeration Systems:</b> Thermodynamic processes, priority criteria and suitability of air refrigeration system. Types of Air refrigeration system, Simple, Boot Strap, Regeneration, Reduced Ambient. Evaporative System. Comparison of these cycles, Numerical on above cycles.	<b>07</b>

3	<p><b>Simple Vapor Compression Refrigeration Systems:</b>            Limitations of Reversed Carnot cycle with vapor as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP. Analysis of cycle.</p> <p><b>Compound Vapor Compression Refrigeration systems:</b>            Multistage Refrigeration Systems- Necessity of compound compression, Compound VC cycle, Inter-cooling with liquid sub –cooling and / or water intercooler.</p>	08
4	<p><b>Miscellaneous Refrigeration cycles &amp; Introduction to Load Estimation:</b>            Vapor Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration. Steam Jet Refrigerating System- Introduction, Relative merits and demerits, Performance Applications. Load estimation techniques and methodology.</p>	03
<b>Total</b>		<b>21</b>
<b>SECTION-II</b>		
5	<p><b>Psychometry of Air &amp; Air Conditioning Processes:</b>            Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychometric processes in air washer, Problems.</p>	07
6	<p><b>Applied Psychometry:</b>            Representation of various psychometric processes on psychometric chart and their analysis, Adiabatic mixing of streams, By pass factor, sensible heat factor, RSHF, ESHF, GSHF, ADP, Ventilation and infiltration Use of psychometric charts.</p>	07
7	<p><b>Air-conditioning Systems (introduction only):</b>            Central air-conditioning system. Unitary air-conditioning system.</p>	01
8	<p><b>Air Conditioning Duct Design:</b>            Energy balance equations for ducts, Design of air conditioning duct system based on velocity reduction method &amp; equal friction method. Equivalent diameter of circular and rectangular ducts.</p>	06
9	<p><b>Miscellaneous Topics:</b>  <b>Refrigerants:</b> Classification, Desirable properties of refrigerant, Nomenclature of Refrigerants, Green House effects.  <b>Applications</b> of Refrigeration and Air-conditioning: Food Preservation, Transport air conditioning, and Industrial applications.            Power saving guide and electricity consumption rating for HVAC equipments.</p>	00*
<b>Total</b>		<b>21</b>

## Instructional method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory. Minimum two internal exams (which may be different from traditional exam) will be conducted and average of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures. Minimum eight experiments and approximate seven tutorials shall be there in the laboratory related to course contents.
- \* **"Miscellaneous Topics" should be considered as a self study for students.**

## Reference Books:

1. Pita Edward G, "Air conditioning principles and systems", Prentice-Hall of India Private Limited, New Delhi.
2. Stoecker W. F & Jones J. W, "Refrigeration and air-conditioning", McGraw Hill International, New York
3. C.P.Arora, "Refrigeration and air-conditioning", Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. P.S. Desai, "Modern refrigeration and air conditioning for engineers", principles, practice and application, Khanna Publishers.
5. Thipse S.S, "Refrigeration and air conditioning", Jaico Publishing House, Mumbai
6. Rajput R.K "Refrigeration and air conditioning", S. K. Kataria & Sons, Delhi
7. Ballaney P.L, "Refrigeration and air conditioning", Khanna Book Publishing Co. (P) Ltd. Delhi.

## Additional Resources

- [http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/New\\_index1.html](http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/New_index1.html)
- <http://nptel.ac.in/courses/112105128/>
- <http://www.newagepublishers.com/samplechapter/001246.pdf>

<b>Course Title</b>	<b>AUTOMOBILE ENGINEERING</b>
<b>Course Code</b>	<b>ME707</b>
<b>Course Credit</b>	Lecture : 03
	Practical : 01
	Tutorial : 00
	Credits : 04

### Course Learning Outcomes

After Successful completion of the above course, students will be able to:

- **Identify** the different components in automobile engineering.
- **Understand** the construction and working principle of various parts of an automobile.
- **Express** working of different auxiliary and transmission systems.
- **Analyze** problems related to automobile components and parts maintenance.
- **Develop** and modify existing components of automobile assembly.

### Detailed Syllabus

Sr. No.	Name of chapter & Details	Hours Allotted
<b>SECTION - I</b>		
<b>1</b>	<b>Introduction to Automobile:</b> History of automobile and classification of automobiles. Main parts of automobiles & vehicle assemblies specifying an automobile. Resistance to the motion of the vehicle. Power required for propulsion of the vehicle. Power required for acceleration.	<b>2</b>
<b>2</b>	<b>Frame &amp; Body :</b> Layout of chassis. Types of chassis frames and bodies, their constructional features and materials.	<b>2</b>
<b>3</b>	<b>Transmission System :Clutch</b> Necessity of a clutch, Requirements of good clutch. Different types of clutch, Clutch; single plate, multiple, cone clutch, semi centrifugal, Fluid Coupling.	<b>4</b>
<b>4</b>	<b>Gear Boxes:</b> Gear boxes, Sliding mesh, constant mesh, Synchromesh and epicyclic gear boxes. Automatic transmission system, Hydraulic torque converter; overdrive, propeller shaft, universal joints, front wheel drive. Differential; Rear axle drives, Hotchkiss and torque tube drives. Rear axle types; Two wheel and four wheel drive.	<b>5</b>

5	<p><b>Running Gear :</b> Type of wheels and tyres, Tyre construction: tyre inflation pressure, tyre wear and their causes; re-treading of the tyre. Steering system, steering gear boxes, steering linkages, steering mechanism, under and over steering, steering geometry. Effect of chamber, caster, king pin inclination, toe in and toe out, power steering.</p>	4
6	<p><b>Suspension System:</b> Principle, type of suspension system. Conventional and independent front and rear axle, spring, rubber and air suspensions. Automatic/hydro suspension system, shock absorbers.</p>	4
<b>Total</b>		<b>21</b>
<b>SECTION-II</b>		
7	<p><b>Brakes:</b> Principle, braking distance, braking efficiency, weight transfer, wheel skidding. Principle and working of various types of brakes, power assisted brakes, hand brake, anti-lock brake systems (ABS). Diagnosis of faults, adjustment and maintenance of brakes.</p>	4
8	<p><b>Battery, Lighting System , Accessories and Safety System :</b> <b>Battery:</b> Construction, working, methods of rating, faults, charging methods, test, generator and cranking motor with drive purpose, construction, faults and diagnosis, voltage and current regulator, purpose, typical circuit, layout, working principle, voltage setting. <b>Lighting system:</b> Wiring system, head lights, aiming of head lights, indicating lights. <b>Accessories</b> like direction indicators, hazard flashes, horn, speedometer, tachometer, wind screen wiper, wind screen washer, central locking system, power windows, and vehicle tracking system.</p>	6
9	<p><b>Automotive Safety :</b> Safety requirements, Safety Devices, Air bags, belts, radio ranging. NVS (Night Vision System). GPS (Global Positioning System) etc.</p>	3
10	<p><b>Regulation and Standardization of Vehicles:</b> Motor vehicle act, registration of motor vehicles. Driving license, control of traffic, insurance against third party, claims for compensation, traffic signs. Central motor vehicle rules, vehicle safety standards and regulations. Classification and definition of vehicles, enforcement of emission norms, duties of surveyor.</p>	4
11	<p><b>Modern Vehicles:</b> Construction and operational features of four wheelers available in Indian market. Introduction to electric vehicles &amp; hybrid vehicles.</p>	4
<b>Total</b>		<b>21</b>



## Instructional Method and Pedagogy:

- At the beginning of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Minimum two internal exams will be conducted and average of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regularly.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Tutorials and assignments are to be submitted as term-work in laboratory related to course contents.

## Text book & Reference Books:

1. Kirpal Singh, "Automobile Engineering Vol- I & II" Standard Pub.& Dist.
2. R.K.Rajput, "Textbook of Automobile engineering" Laxmi Publication.
3. K.M. Gupta, "Automobile Engineering Vol- I & II", Umesh Pub.
4. R.B.Gupta, "Automobile Engineering", Satya Prakashan.
5. N.K.Giri, "Automobile Technology", Khanna Pub.
6. W.Crouse, "Automotive Mechanics", Tata Mc Graw Hill.
7. G.B.S.Narang, "Automobile Engineering", Khanna Pub.
8. P.L. Kohli, "Automotive Chassis and Body Vol. 1 & 2",

## Additional Resources:

- <http://auto.howstuffworks.com/car-suspension.htm>
- [www.carbibles.com](http://www.carbibles.com)
- <http://www.wisegeek.org/what-is-a-gearbox.htm>
- <http://lifehacker.com/the-preventative-maintenance-you-need-to-do-on-your-car-1394196018>
- <http://www.dummies.com/how-to/home-garden/automobiles/Basic-Repair-and-Maintenance.html>
- <http://www.theaa.com/breakdown-cover/car-maintenance-tips.html>
- <http://www.dmv.org/how-to-guides/vehicle-maintenance.php>

<b>Course Title</b>	<b>COMPUTER INTEGRATED MANUFACTURING</b>
<b>Course Code</b>	<b>ME708</b>
<b>Course Credit</b>	Lecture : 03
	Practical : 01
	Tutorial : 00
	Total : 04

### Course Learning Outcomes

**After Successful completion of the course, students will be able to:**

- **Introduce** the conceptual details about the computer integrated manufacturing system available in the industry.
- **Develop** part programming for CNC.
- **Introduce** the concept of Industrial Robots and its application in Industries.
- **Manage** effective systems, processes, and environments for contemporary manufacturing enterprises using Computer.
- **Implement** the Computer in Process Planning and Production Management.

### Detailed Syllabus

Sr. No.	Name of chapter & Details	Hours Allotted
<b>Section - I</b>		
<b>1</b>	<b>Computer Integrated Manufacturing System:</b> Introduction to CIM Concept, Scope of CIM, Type of Manufacturing Systems, Evolution, Benefits of CIM, Machine tools and related Equipment, Material Handling System, Computer Control System, Human Labor in the Manufacturing System, Role of Management in CIM, Expert System & Participate Management, Impact of CIM on Personnel, Role of Manufacturing Engineers, CIM Wheel.	<b>05</b>
<b>2</b>	<b>Flexible Manufacturing Systems:</b> Introduction, FMS Components, Types of FMS, FMS applications and Benefits, Flexibility, FMS Layouts and essentials, FMS Planning and Implementation Issues, Tool Management, Tool Supply System, Tool Monitoring System, Work piece Handling, Automated Material Movement, Automated Storage / Retrieval System, Automated Guided Vehicle.	<b>07</b>
<b>3</b>	<b>Computer – Integrated Production Management:</b> Computer – Aided Process Planning: The Planning Function, Retrieval Type Process Planning Systems, Generative Process Planning Systems, Benefits of CAPP, Machinability Data Systems and Computer Generated Time Standard. Production Planning and Control: Introduction, Traditional Production Planning and Control, Problems with Traditional Production Planning and Control, Computer Integrated Production Management System. Inventory Management and MRP: Introduction, Inventory Management, Material	<b>09</b>

	Requirement Planning (MRP), Manufacturing Resource Planning (MRP II). Shop Floor and Computer Process Monitoring: Introduction, Functions of Shop Floor System, The Shop Floor Control System, Operation Scheduling, The Factory Data Collection System, Computer Process Monitoring.	
<b>Total</b>		<b>21</b>
<b>Section – II</b>		
<b>4</b>	<b>Numerical Control of Machines:</b> Introduction, Evolution of Controllers, Components of Numerical Control System, Classification of Numerical Control Machines, Method of Listing the Coordinates of Points in NC / CNC Systems, Axis Identification in NC / CNC Machines, Constructional Details of CNC Machines, Fundamentals of Part Programming, Manual Part Programming for Drilling, Turning and Milling Machine Operations, Part Programming using Subroutines, Do Loops and Canned Cycles, Computer - Assisted Part Programming, Tooling for CNC Machines, Maintenance of CNC Machine Tools.	<b>12</b>
<b>5</b>	<b>Group Technology:</b> Introduction, Part Families, Parts Classification and Coding Systems, Cellular Manufacturing, Production Flow Analysis, Group Technology Machine Cells, Quantitative Analysis in Cellular Manufacturing, Benefits of Group Technology.	<b>04</b>
<b>6</b>	<b>Industrial Robots:</b> Introduction, Robot Physical Configuration, Basic Robot Motions, Technical Features, Programming the Robot, Robot Programming Languages, End Effectors, Work Cell Controls and Interlocks, Robotic Sensors, Robot Applications.	<b>05</b>
<b>Total</b>		<b>21</b>

### Instructional Method and Pedagogy

- Lectures will be conducted with the aid of multi-media projector, blackboard, OHP etc.
- Assignments based on course content will be given to the student's at the end of each unit/ topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/will be conducted.
- The course includes tutorials, where students have an opportunity to practice the examples for the concepts being taught in lectures.
- Simulation of Machining Perform in practical time.
  - Drilling, Turning and Milling Operations.
- Only group Practical/demo will be done/shown in practical time.
  - Machining on Computer Numerical Control Vertical Machining Centre
  - Demonstration of Computer Assisted Part Programming

### Reference Books

1. Groover Mikell P., “Automation, Production Systems, and Computer Integrated Manufacturing”, Pearson Education, Delhi.
2. Vajpayee S. Kant, “Principles of Computer Integrated Manufacturing”, Prentice-Hall of India Private Limited, New Delhi.
3. Groover Mikell P., Zimmers Emory W., “CAD/CAM: Computer Aided Design and Manufacturing”, Prentice-Hall of India Private Limited, New Delhi.
4. Radhakrishnan P., “CAD/CAM/CIM”, New Age International Publisher Pvt. Ltd. New Delhi.
5. Adithan M. Pabla B.S., “CNC Machines”, New Age International Publisher Pvt. Ltd. New Delhi.
6. Narang J. S., Walia S. K., Narang V. D. S., “Computer Aided Manufacturing (CNC and Robotics)”, Dhanpat Rai & Co. (P) Ltd Delhi.
7. Groover Mikell P., Weiss Mitchell, Nagel Roger N., Odrey Nicholas G., “Industrial Robotics: Technology, Programming, and Applications”, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

### Reading Materials, web materials with full citations

- <http://www.sme.org/fmp/>
- <http://iitvids.blogspot.in/2012/12/manufacturing-processes-ii.html>
- <http://www.cosmolearning.com/courses/manufacturing-processes-i-538/video-lectures/>
- <http://www.ias.ac.in/sadhana/>

<b>Course Title</b>	<b>PRODUCTION TECHNOLOGY</b>
<b>Course Code</b>	<b>ME709</b>
<b>Course Credit</b>	Lectures :03
	Practical :01
	Tutorial :00
	Total :04

### Course Learning Outcomes:

After successful completion of the course, students will be able to:

- **Define** the role and value of production using cutting tools.
- **Select** production tools, machines, and equipment and use them safely, accurately, and economically.
- **Build** impacts of production on society, economy, culture, and the environment using nontraditional manufacturing processes.
- **Identify** proper sheet metal forming processes on press.

### Detailed Syllabus

Sr. No.	Name of Chapter & Details	Hours allotted
<b>SECTION - I</b>		
<b>1</b>	<b>Design of Metal Cutting Tools:</b> Principles of metal machining, cutting tools and tool materials, design of single point and multipoint cutting tool, design for optimum geometry, design strategies and materials used for cutting tools, design of form tool, tool signature, mechanics of chip removal, cutting forces and parameters effecting it, Merchant's analysis of metal cutting, cutting fluids, tool wear, tool life, economics of machining, design of drills, reamers, milling cutters, broach & gear cutting tools, temperature measurement at tool-work interface and its effects.	<b>8</b>
<b>2</b>	<b>Gear and Threads Manufacturing:</b> Different types of gear forming and generating methods and gear finishing processes, different types of threads manufacturing methods and tools required to manufacturing.	<b>6</b>
<b>3</b>	<b>Design of Jigs and Fixtures:</b> Definition, its usefulness in mass production, principles of location and clamping, locating & clamping, materials for locating and clamping elements, drilling bushes, design of various jigs & fixtures, types of locators & clamps, jig bushes, design of jigs and fixtures for various machining operations.	<b>7</b>
<b>Total</b>		<b>21</b>

## SECTION - II

<b>4</b>	<b>Presses and Press Work:</b> Types of press machines and dies, cutting actions in dies, clearance, cutting forces, center of pressure design of press tools, methods of mounting of punches minimize scrap, strip layout.	<b>7</b>
<b>5</b>	<b>Controls in Machine Tools:</b> Introduction, machine tool drives, structures and spindles, special purpose machine tools, capstan and turret lathes, single spindle and multi spindle automatic machine tools, bar type and chucking type machines, design of cam for single spindle automat transfer machines.	<b>7</b>
<b>6</b>	<b>Unconventional Machining Process :</b> Introduction, limitations of conventional machining processes, requirements and types of unconventional machining process, principle and working and applications of un-conventional machining processes such as electric discharge machining (EDM), electro-chemical machining (ECM), ultrasonic machining (USM), abrasive jet machining (AJM).	<b>7</b>
<b>Total</b>		<b>21</b>

### Instructional Method and Pedagogy:

At the beginning of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Minimum two internal exams will be conducted and total of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regularly.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Only group Practical/demo will be done/shown in practical time.
  - Preparation of Single Point Cutting Tool using Tool and Cutter Grinder.
  - Various types of Chips, Chip Breakers and Inserts.
  - Determination of Value of Cutting Temperature.
  - Different operations using Capstan Lathe.
  - Different operations using Automatic lathe.

### Reference Books:

1. Boothroyd, "Fundamentals of machining and Machine tools", CRC Publication.
2. M.C.Shaw, "Metal cutting Principles", Oxford University Press, New Delhi.
3. Rao P. N., "Manufacturing Technology Vol. II – Metal cutting and Machine tools", Tata McGraw Hill, New Delhi.
4. H.M.T., "Production Technology", Tata McGraw Hill, New Delhi.
5. Sharma P. C., "A Text book of Production Engineering", S. Chand Publishers, New Delhi.

6. Donaldson, "Tool Design", Tata McGraw Hill, New Delhi.
7. Chapman W. A., "Workshop Technology Vol.II", Taylor & Francis.
8. R.K Jain "Production Technology" khanna publishers, New Delhi.

**Reading Materials, web materials with full citations:**

- <http://www.sme.org/fmp/>
- <http://iitvids.blogspot.in/2012/12/manufacturing-processes-ii.html>
- <http://www.cosmolearning.com/courses/manufacturing-processes-i-538/video-lectures/>

<b>Course Title</b>	<b>DESIGN OF HEAT EXCHANGE EQUIPMENTS</b>
<b>Course Code</b>	<b>ME710</b>
<b>Course Credit</b>	Theory :03
	Practical :01
	Tutorial :00
	Credits :04

**Course Learning Outcomes:**

**After Successful completion of the above course, students will be able to:**

- **Classify** common heat exchanger types, their advantages and limitations
- **Describe** rating and sizing problems in heat exchanger design
- **Explain** how to consider fouling of surfaces, incorporate fouling in designs, and handle fouling during heat exchanger operation
- **Express** how to design common types of heat exchangers; namely shell-and-tube, gasketed plate.
- **Illustrate** how to select appropriate Heat Exchanger for the given application.
- **Analyze** different types of heat exchanger and its components.

**Detailed Syllabus**

<b>Sr. No.</b>	<b>Name of chapter &amp; details</b>	<b>Hours Allotted</b>
<b>SECTION-I</b>		
<b>1.</b>	<b>Classification Of Heat Exchangers</b> Introduction, Recuperation & regeneration, Tabular heat exchangers, Double pipe, shell & tube heat exchanger, Plate heat Exchangers, Gasketed plate heat exchanger. Spiral plate heat exchanger, Lamella heat exchanger, Extended surface heat exchanger, Plate fin and Tabular fin. Double Pipe Heat Exchanger,	<b>09</b>
<b>2.</b>	<b>Basic Design Methods of Heat Exchanger:</b> Introduction, Basic equations in design, Overall heat transfer coefficient, LMTD method for heat exchanger analysis, $\epsilon$ -NTU method for heat exchanger Analysis, Parallel flow, Counter flow. Multi pass, cross flow heat exchanger design calculations.	<b>07</b>



<b>3.</b>	<b>Introduction Of Miscellaneous Heat Exchanger</b> Double pipe Heat exchanger, Aluminum Heat Exchangers, Titanium Heat Exchangers, U-Tube Heat Exchangers, Copper Heat Exchangers, Cupro-Nickel Heat Exchangers, Pharmaceutical Heat Exchangers, Cryogenic Heat Exchangers, Marine Heat Exchangers, Plate-Fin Heat Exchangers	<b>05</b>
<b>Total</b>		<b>21</b>
<b>SECTION-II</b>		
<b>4.</b>	<b>Fouling of Heat Exchangers</b> Introduction, Basic considerations, Effects of fouling, Aspects of fouling, Design of heat exchangers subjects to fouling, Operations of heat exchangers subjects to fouling, Techniques to control fouling.	<b>09</b>
<b>5.</b>	<b>Condensers and Evaporators.</b> Condensers classification and design methods for surface condensers. Evaporators – Classification and design methods	<b>07</b>
<b>6.</b>	<b>Heat Transfer Enhancement And Performance Evaluation</b> Enhancement of heat transfer, Performance evaluation of heat transfer, Enhancement Technique, Introduction to Pinch Analysis	<b>05</b>
<b>Total</b>		<b>21</b>

## Instructional method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board.
- Attendance is compulsory in lectures and laboratory. Minimum two internal exams will be conducted and average of two will be considered as a part of overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures. Minimum ten experiments shall be there in the laboratory related to course contents.
- Use of different charts and graph is required.

## Reference Books:

1. Sadik Kakac, and Hongtan Liu, "Heat Exchangers: Selection, Rating and Thermal Design", CRC Press.
2. R. K. Shah, D. P. Sekulic, "Fundamentals of Heat Exchanger Design", John Wiley and Sons, Inc.
3. D.Q.. Kern, "Process Heat Transfer", McGraw Hill.
4. Frank P. Incropera and David P. De Witt, "Fundamentals of Heat Transfer", Wiley, Eastern Limited.
5. Kays and London, "Compact Heat Exchanger".

## Additional Resources

- [www.nptel.ac.in/courses/103103032/](http://www.nptel.ac.in/courses/103103032/)(For Video lectures)
- [http://www.webbustorz.com/products/shell-tube-heat-exchanger-design](http://www.webbustorz.com/products/shell-tube-heat-exchanger-design/) ( For software)
- [web.iitd.ac.in/](http://web.iitd.ac.in/)
- <http://www.explainthatstuff.com>
- <http://www.thomasnet.com/articles/process-equipment/heat-exchanger-types>

<b>Course Title</b>	<b>CAPSTONE DESIGN - I</b>
<b>Course Code</b>	<b>ME711</b>
<b>Course Credit</b>	Lecture : 00
	Practical : 00
	Tutorial: : 00
	Total: : 05

### Course Learning Outcomes

**At the end of course, students will be able to:**

- **Identify, formulate and analyse** an engineering problem.
- **Acquire** the knowledge of the techniques, skills, and modern engineering tools necessary for engineering practice.
- **Design** the solution of identified problem and Implement the same.
- **Analyze** the outcomes of implemented solution.
- **Present** features of the developed project to the targeted group through written and oral communication.
- **Contribute** in a team in development of technical project.

### Project Definition

Project work shall be based on any of the following or other:

- fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
- experimental verification of principles used in Mechanical Engineering Applications.
- product design and development.
- design and development of laboratory equipments/test rigs.
- developing computer programs/software.
- industry based project.
- industry need based basic survey or Testing or Analysis etc.

## Instructional Method and Pedagogy:

- our project work may be carried out in two semester known as project Phase -1 and project Phase-2 in consecutive last two semesters.
- reliminary work of project should be completed within project work like Finalisation of topic, literature study, methodology etc.
- ach student should maintain log book for the progress of project work. In this book you will keep a log of your weekly work. You must get this signed (and dated) by your supervisor every week. It will be handed in with your final report, and should cover the following headings:
  - Progress (from previous week)
  - Problems & Queries,
  - Objectives (for next week)
  - Date of Meeting
  - Sign of Supervisor
- Each student has to prepare and submit the Report with CD-R which will consists of .doc & .pdf format of report and .ppt format of presentation at the time of final presentation of project Phase -1 and project Phase -2.
- One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should remain with each student of the project group.
- The project term work shall be evaluated on the basis of reviews.
- Two reviews are to be taken in Project Phase -1 and Project Phase -2.
- Oral examination shall be conducted along with final presentation of the project.

## Report Layout

1. Cover Page & Title Page
2. Declaration
3. Certificate
4. Project work Approval
5. Acknowledgement
6. Table of Contents
7. Abstract
8. List of Table
9. List of Figures
10. List of Symbols, Abbreviations and Nomenclature
11. Chapters
12. Appendices
13. References

## Project Report Preparation Guideline

- Paper must be White Royal Executive Bond, not less than 85 gsm Paper of A4 size.
- Font size type and margins

Details	Font Type	Font size	Spacing
Facing page (cover and first page) - see sample page for details	Times New Roman	14pt bold capitals	Centered (Adjustable spacing)
Chapter headings with chapter number on top	Times New Roman	14pt bold capitals	Centered
Section headings	Times New Roman	12pt bold capitals	Left adjusted
Subsection headings	Times New Roman	12pt. sentence case	Left adjusted
Paragraph headings	Times New Roman	12pt. bold sentence case	Left adjusted
Body of Project report	Times New Roman	12 pt	Justified and with 1.5 spacing for text and equations
Margins	Left Margin	1.5 inch	To accommodate binding area
	Right Margin	1.25 inch	
	Top	2.0inch	On pages on which chapter begins
		1.25 inch	Other pages
Bottom	1.25 inch		

- References can be given as per format given in IEEE journals.
- Bibliography contains materials that were useful for the preparation of the Project report in a general way and is not directly referred to in the Project report.

## Additional Resources:

- -journal available at library portal.

Course Title	INDUSTRIAL INTERNSHIP
Course Code	PC701
Course Credit	05

### Outcomes:

- **Learn** public relations by examining it from a practitioner 'Perspective'.
- **Learn** more about yourself and your skills, identifying areas for improvement.
- **Propose** and **analyze** the knowledge gained through academic learning in the classroom to the work environment.
- **Identify** the career development opportunity for a position in order to pursue a particular interest or career option.
- **Identify** the technical skills, best practices and knowledge required in the workplace.
- **Identification** of Problem for final year Project

### Pedagogy

A student is required to undergo 4 weeks of Industry Orientation as partial requirement for the award of the degree. This would be at one or more related industry units.

A student's practical experience, under supervision in a well-administered agency, office, industry or organization should be commensurate with his or her level of education and future career goals. While the evaluation of the student's performance in the internship is based primarily on academic criteria, the practical experience, prospective career fields, and learning about her or his ability to function in a given occupational environment.

**Course:** B.Tech III year Summer All branches

**Duration :** 4 weeks

## Rules and Regulations

- Interns are expected to keep an internship diary that will provide them, the industry representative with an accounting of the intern's activities.
- The internship diary will also provide the basis for keeping track of the intern's time, the progress toward meeting the Learning objectives, and as a reference for some of the course assignments.
- The daily log entries should describe activities and the student's reflections concerning those activities and the experiences.
- The internship is 4 weeks and it is compulsory for graduation.
- The assessment form should be completed by the industry supervisor at the end of the training period.
- The industry should either post the diary in a sealed and stamped envelope or allow the student to deliver it directly to the head of the department within one month of the following semester.
- If there is any doubt as to whether a student may have falsely completed the diary or made false declarations about the industry, the supposedly completed training will be disqualified.
- This diary should include original knowledge gained from plant, site or office rather than practical knowledge obtained from books or lecture notes.
- The student is advised to photographs, plans, specifications and detailed analysis etc. to support his or her internship report with prior permission.
- The log should have an entry for each day that a student works hours at her or his internship. Each entry should contain:
  - The date
  - Hours worked (time in and time out)
  - A description of that day's activities and
  - Reflections about how that day's activities connect with/contribute to meeting one's objectives and/or what one learned