Scheme & Syllabus

Bachelor of Vocation (B.Voc.)
[Refrigeration & Air Conditioning]

(Batch 2024 & onwards)

SHAHEED BHAGAT SINGH STATE UNIVERSITY, FEROZEPUR

Department of Mechanical Engineering

Bachelor of Vocation (B.Voc.)

(Refrigeration & Air Conditioning)

B.Voc. (Refrigeration Air- Conditioning)

Duration of course* **: 3 years**

Eligibility **: 10+2 (any stream)**

***Exit Options**

The programme allows exit of a student in an intermediate stage and exit options will be as below:

Exit Point	Duration	Certificate/ Diploma/ Degree offered
First Exit	After 1 year	Diploma in Vocation (D.Voc.)
Second Exit	After 2 years	Advanced Diploma in Vocation (Adv.D.Voc.)
Third Exit	After 3years	Bachelor of Vocation (B.Voc.)

SHAHEED BHAGAT SINGH STATE UNIVERSITY, FEROZEPUR
Study Scheme & Syllabus of B.Voc. (Refrigeration & Air Conditioning), 2024 & onwards

Semester-1

Bachelor of Vocation (B.Voc.) Refrigeration and Air Conditioning								
Course Code	**Title of the course**	**L**	**T**	**P**	**Marks Distribution**		**Total Marks**	**Credits**
					Internal	**External**		
General Academic Components								
BVRC 101	Fundamentals of Computers	3	1	-	40	60	100	4
BVRC 102	Basic Electrical & Electronics Engineering	3	1	-	40	60	100	4
BVRC 103	Computer Lab.	-	-	6	60	40	100	3
BVRC 104	Thermodynamics in Refrigeration & Air Conditioning	3	1	-	40	60	100	4
Skill Development Components								
BVRC 105	Basic Heat Transfer	3	1	-	40	60	100	4
BVRC 106	Heat Transfer Lab.	-	-	2	60	40	100	1
BVRC 107	Project–I [#]	-	-	-	60	40	100	10
SBS 101C	Introduction to Shaheed Bhagat Singh & his Co-Patriotes	1	0	0	Satisfactory/Non-Satisfactory			0
	Total	**13**	**4**	**8**	**340**	**360**	**700**	**30**

[#]Concerned Head of Department will assign Project-I to faculty member(s) as coordinator with Load of 2 hrs/week.

SHAHEED BHAGAT SINGH STATE UNIVERSITY, FEROZEPUR
Study Scheme & Syllabus of B.Voc. (Refrigeration & Air Conditioning), 2024 & onwards

Semester-2

Bachelor of Vocation (B.Voc.) Refrigeration and Air Conditioning								
Course Code	**Course Title**	**Load Allocation**			**Marks Distribution**		**Total Marks**	**Credits**
		L	**T**	**P**	**Internal**	**External**		
General Academic Components								
BVHU 201	Communication Skills in English	3	1	-	40	60	100	4
BVRC 201	Workshop Technology	3	1	-	40	60	100	4
BVRC 202	Workshop Practice	-	-	6	60	40	100	3
BVRC 203	RAC piping system	3	1	-	40	60	100	4
Skill Development Components								
BVRC 204	Basics of Refrigeration &Air Conditioning	3	1	-	40	60	100	4
BVRC 205	Refrigeration & Air-conditioning Lab.-I	-	-	2	60	40	100	1
BVRC 206	Project-II #	-	-	-	60	40	100	10
	Total	**12**	**4**	**8**	**340**	**360**	**700**	**30**

#Concerned Head of Department will assign Project-II to faculty member(s) as coordinator with Load of 2 hrs/week.

Semester-3

Bachelor of Vocation (B.Voc.) Refrigeration and Air Conditioning								
Course Code	**Title of the course**	**L**	**T**	**P**	**Marks Distribution**		**Total Marks**	**Credits**
					Internal	**External**		
General Academic Components								
BVRC 301	Environmental Studies	3	1	-	40	60	100	4
BVRC 302	Refrigeration Systems	4	1	-	40	60	100	5
BVRC 303	Industrial Management	3	1	-	40	60	100	4
BVRC 304	Metrology and Measuring Instruments	3	1	-	40	60	100	4
Skill Development Components								
BVRC 305	Metrology and Measuring Lab.	-	-	2	60	40	100	1
BVRC 306	Refrigeration & Air Conditioning Lab.-II	-	-	4	60	40	100	2
BVRC 307	Project-III #	-	-	-	60	40	100	10
	Total	**13**	**4**	**6**	**340**	**360**	**700**	**30**

#Concerned Head of Department will assign Project-III to faculty member(s) as Coordinator with Load of 2 hrs/week.

Semester-4

Bachelor of Vocation (B.Voc.) Refrigeration and Air Conditioning								
Course Code	**Title of the course**	**L**	**T**	**P**	**Marks Distribution**		**Total Marks**	**Credits**
					Internal	**External**		
General Academic Components								
BVRC 401	Air-Conditioning Systems	3	1	-	40	60	100	4
BVRC 402	Engineering Materials	3	1	-	40	60	100	4
BVRC 403	Refrigerants	3	1	-	40	60	100	4
Skill Development Components								
Elective-I (Anyone from BVRC 404 and BVRC 405)								
BVRC 404	Refrigeration & Air conditioning Standards	2	1	-	40	60	100	3
BVRC 405	Refrigeration & Air conditioning Equipment	2	1	-	40	60	100	3
BVRC 406	Cooling Towers & Air Handling Units	3	1	-	40	60	100	4
BVRC 407	Refrigeration & Air-Conditioning Lab.-III	-	-	2	60	40	100	1
BVRC 408	Project-IV[#]	-	-	-	60	40	100	10
	Total	**16**	**6**	**2**	**320**	**380**	**700**	**30**

[#]Concerned Head of Department will assign Project-IV to faculty member(s) as coordinator with Load of 2 hrs/week.

SHAHEED BHAGAT SINGH STATE UNIVERSITY, FEROZEPUR
Study Scheme & Syllabus of B.Voc. (Refrigeration & Air Conditioning), 2024 & onwards

Semester-5

Bachelor of Vocation (B.Voc.) Refrigeration and Air Conditioning								
Course Code	**Title of the course**	**L**	**T**	**P**	**Marks Distribution**		**Total Marks**	**Credits**
					Internal	**External**		
General Academic Components								
BVRC 501	Safety in Refrigeration & Air conditioning Systems	4	1	-	40	60	100	5
Elective-II (Any one from BVRC 502 and BVRC 503)								
BVRC 502	Human Resource Management	3	1	-	40	60	100	4
BVRC 503	Economics for Engineers	3	1	-	40	60	100	4
BVRC 504	Entrepreneurship	3	1	-	40	60	100	4
Skill Development Components								
BVRC505	Maintenance of Refrigeration & Air-Conditioning systems	4	1	-	40	60	100	5
BVRC 506	Refrigeration & Air-Conditioning Lab.-IV	-	-	4	60	40	100	2
BVRC 507	Project-V #	-	-	-	60	40	100	10
	Total	**14**	**4**	**04**	**280**	**320**	**600**	**30**

#Concerned Head of Department will assign Project-V to faculty member(s) as coordinator with Load of 2 hrs/week.

Semester-6

Bachelor of Vocation (B.Voc.) Refrigeration and Air Conditioning								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BVRC 601	Industrial Training	-	-	-	400	300	700	30
	Total	-	-	-	**400**	**300**	**700**	**30**

First Semester
(Refrigeration and Air Conditioning)

BVRC101: FUNDAMENTALS OF COMPUTERS

Semester	1					
Course code	BVRC101					
Course title	Fundamentals of Computers (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

UNIT– I

- What is Computer, Block Diagram (Components),Application of Computer, Booting of Computer System
- Elements of Computer System (Input devices (Keyboard, Scanner, Mouse),
- Output devices–(Printer, Monitor),Storage Devices–(Magnetic Disk, Optical Disks)
- What is Operating System, Types of Operating System (Multitasking, Multi-programming, Multiprocessing)

UNIT– II

- Introduction to Windows Vista
- PartsofWindowsScreen(Desktopicons,Windows(ApplicationWindow,Document window)
- Introduction to MS Office
- Introduction to MS Word (Word 2003)
- Parts of Word Window(Title Bar, Menu Bar)
- Opening, Closing and saving a word Document
- Font Dialog Box
- Page Setup
- Editing a word document (Cut,Copy,Paste,Bold,Italic, Underline)
- Print Dialog Box
- Creating aTable, Operations on Table in MS Word

TEXT BOOKS:

1. Computers Fundamentals and Architecture by B.Ram
2. William Stallings, Operating System, Pearson Education
3. Norton, Introduction to Computers, McGraw Hill

REFRENCES BOOKS:

1. P C Software for Windows by R K Taxali
2. P C Software Bible by S.Jaiswal
3. Computers Today: Suresh K.Basandra
4. Operating System :Achyut S.Godbole
5. Understanding Computer Fundamentals &Dos By G.K.Iyer
6. MS-Office Interactive course by Greg Perry, Techmedia
7. MS Office Complete Reference TMH Publication.

BVRC102: BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Semester	1					
Course code	BVRC102					
Course title	Basic Electrical & Electronics Engineering (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

Unit–I

Nature of Electricity, A brief review of various applications of electricity, Introduction to DC and AC circuits, difference between Alternating current & Direct current, Ohm's Law-statement, Circuit elements & their Characteristics - Resistor, capacitor & inductance, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's Current and Voltage Law, Ideal sources – equivalent resistor, current division, voltage division, Electrical quantities- Charge, Current, Voltage, Power, Electrical Energy, Electrical Potential and their units.

UNIT– II

Introduction to simple magnetic circuits, Concept of Faraday's laws of Electromagnetic induction, production of alternating e.m.f. – single phase system.

UNIT– III

Basic principles and classification of Indicating instruments, Analog and Digital multimeter & Voltmeter, Measurement of Power ,energy & resistance, Control and Protection devices-Relays, Circuit Breaker, fuses MCB, LCB.

UNIT– IV

Difference between conductors, insulators and semi conductors, Formation of p & n type semiconductors**;** P-N junction Diode, ideas of- LDR; Electronic instruments– Analog multimeter & Digital voltmeter, Physical quantities measured with digital and analog multimeter.

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RECOMMENDED BOOKS:

1. Fundamental of Electrical and Electronic Engineering by B.LTheraja; S.Chand and Company, New Delhi.
2. Basic Electronic and Electrical Engineering by Bhattacharya S K, Pearson Education.
3. Basic Electronic and Electrical Engineering by D.P.Kothari, I .J.Nagrath ; McGraw Hill Education Private Limited.
4. Principles of Electrical Engineering by Gupta BR; S.Chand and Company, New Delhi

BVRC 103: COMPUTER LAB

Semester	1					
Course code	BVRC 103					
Course title	Computer Lab (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	6	60	40	3

Practical based on Fundamentals of Computer based on contents studied in theory class (Fundamentals of Computers - BVRC-101) on:

- MS Word and
- Window10

BVRC 104: THERMODYNAMICS IN REFRIGERATION & AIR CONDITIONING

Semester	1					
Course code	BVRC 104					
Course title	Thermodynamics in Refrigeration &Air Conditioning (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

UNIT– I

Definition of thermodynamic terms: System, surroundings, Types of systems, intensive and extensive properties, Thermal equilibrium, Thermodynamic processes: isothermal, isobaric, isochoric, adiabatic, polytropic, throttling, free-expansion; Temperature: different scales of temperature, instruments used for measuring temperature, reversible and irreversible processes, first and second law of thermodynamics.

UNIT– II

Heat, work, various methods of heat flow: conduction, convection, radiation, specific heat, sensible heat, latent heat of vapour & fusion, specific heat of gases & units of heat, melting and boiling point, absolute temperature, difference between heat and temperature, condensation, vaporization.

UNIT– III

Applications of Thermodynamics: Carnot cycle, refrigerator and heat pump, refrigeration, equipments used in refrigeration, application of RAC, methods of refrigeration, terminology of refrigeration, definition of TON as applied to refrigeration, C.O.P., refrigeration effect.

REFERENCE BOOKS:

1. Refrigeration &Air-Conditioning, By S. Domkundwar; Dhanpat Rai & Sons
2. Refrigeration & Air-Conditioning, By S.C. Arora; Dhanpat Rai& Sons
3. A Course in Thermodynamics, By-P.L.Batlaney; Khanna Publishers
4. A Textbook of Thermal Engineering RS Khurmi JK Gupta S. Chand Publishing

BVRC 105: BASIC HEAT TRANSFER

Semester	1					
Course code	BVRC 105					
Course title	Basic Heat Transfer (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

Unit-I

Basics of heat transfer; convection, radiation; Definition of conduction; Thermal conductivity; overall heat transfer coefficient of Composite Wall; heat transfer coefficient of Lagged Pipe; Thermal Conductivity of given Metal Rod.

Unit-II

Introduction to Natural and Forced Convection; heat transfer coefficient of Pin-Fin Determination of heat transfer coefficient of Natural Convection; Determination of heat transfer coefficient of Forced Convection.

Unit-III

Introduction to radiation; Determination of Stefan Boltzman Constant; Determination of Emissivity of test plate.

Unit-IV

Determination of effectiveness and overall heat transfer coefficient using Parallel and Counter flow Heat Exchanger; Determination of heat transfer coefficient in drop and film wise condensation; Determination of Critical Heat flux; Study of heat pipe and its demonstration.

TEXT BOOKS:

1. Heat and mass transfer by PK Nag
2. A Textbook of Thermal Engineering RS Khurmi and JK Gupta S. Chand Publishing

REFERENCE BOOKS:

1. Thermal Engineering by A.S. Sarao Satya Prakashan

BVRC 106: HEAT TRANSFER LAB

Semester	1					
Course code	BVRC 106					
Course title	Heat Transfer Lab (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	2	60	40	1

LIST OF EXPERIMENTS

1. Determination of Thermal conductivity of insulation powder
2. Determination of Thermal Conductivity of given Metal Rod
3. Determination of heat transfer coefficient of Pin-Fin(Natural and Forced Convection)
4. Determination of heat transfer coefficient of Natural Convection
5. Determination of Stefan Boltzman Constant
6. Determination of effectiveness and overall heat transfer coefficient using Parallel and Counter flow Heat Exchanger
7. Study of heat pipe and its demonstration

BVRC 107: PROJECT-I

Semester	1					
Course code	BVRC 107					
Course title	Project-I (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	#	60	40	10

Candidates will make a project related to refrigeration. After making the project, he/she is supposed to have practical knowledge about different parts used in different refrigeration units (domestic & commercial); work related to dismantling & assembly of various parts used in different refrigeration units.

A detailed report will have to be submitted after making the project.

 # Concerned Head of Department will assign Project-I to faculty member(s) as coordinator with Load of 2 hrs/week.

Second Semester
(Refrigeration and Air Conditioning)

BVHU 201: COMMUNICATION SKILLS IN ENGLISH

Semester	2					
Course code	BVHU 201					
Course title	Communication Skills in English (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

Unit–I

Reading Skills: Reading Tactics and strategies; Reading purposes–kinds of purposes and associated comprehension; Reading for direct meanings; Reading for understanding concepts, details, coherence, logical progression and meanings of phrases/ expressions.

Activities:

a) Active reading of passages on general topics
b) Comprehension questions in multiple choice format
c) Short comprehension questions based on content and development of ideas

Unit-II

Writing Skills: Guidelines for effective writing; writing styles for application, resume, personal letter, official/ business letter, memo, notices etc.; outline and revision.

Activities:

a) Formatting personal and business letters
b) Organizing the details in a sequential order
c) Converting a biographical note into a sequenced resume or vice-versa
d) Ordering and sub-dividing the contents while making notes.
e) Writing notices for circulation/ boards

SUGGESTED BOOKS:

1. Applying Communication Theory for Professional Life: A Practical Introduction by Dainton and Zelley
2. Communication Skills : Sanjay Kumar and Pushap Lata
3. On writing well: William Zinsser

BVRC 201: WORKSHOP TECHNOLOGY

Semester	2					
Course code	BVRC 201					
Course title	Workshop Technology (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

Introduction to workshop, Maintenance of workshop tools and machinery, Safety precautions ,Usage of various gauges to measure length, mass, volume, speed, temperature and pressure, diameter of wire by wire gauge, external and internal diameter by vernier caliper, micrometer, screw gauge, pressure by pressure gauge, etc.

- Apart from this general study,contents covered for various shops will be as under:

1. Carpentry Shop: Introduction to various types of woods and carpentry tools.
2. Sheet Metal Shop: Practice of measuring, marking, cutting, bending, folding, riveting, soldering, etc.
3. Electrical Shop: Practice of wire joints, soldering and de–soldering, brazing, familiarization of voltmeter, ammeter, multi meter, etc.
4. Welding Shop: Practice of various joints by Arc Welding, Gas Welding, TIG, MIG and Gas cutting. Types of flames, fluxes, filler rods. Soldering.
5. Machine Shop: Introduction and Practice on Lathe machine, Drilling machines.
6. Fitting shop: Introduction to various types of marking & measuring tools, cutting tools, drilling & tapping practice.

RECOMMENDED BOOKS:

1. Basic Workshop Practice Manual by T Jeya poovan; Vikas Publishing House (P) Ltd. New Delhi
2. Workshop Technology by Manchanda Vol.I,II, III India Publishing House,Jalandhar.
3. Workshop Technology I, II, III, by SK Hajra, Choudhary and A K Chaoudhary.
4. Workshop Technology by B.S.Raghuwanshi, Dhanpat Rai and Co.,New Delhi

BVRC 202: WORKSHOP PRACTICE

Semester	2					
Course code	BVRC 202					
Course title	Workshop Practice (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	6	60	40	3

To prepare jobs related to:

- Welding
- Electrical work
- Lathe machine
- Sheet Metal/soldering
- Foundry
- Heat treatment
- Fitting shop

BVRC 203: RAC PIPING SYSTEM

Semester	2					
Course code	BVRC 203					
Course title	RAC Piping System (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

Unit I

Codes, Standards and Specifications: Piping codes, ASME codes and standards, ASTM Specifications.

Unit II

Piping Components: Pipe-seamless, welded pipes, pipe sizes, dimensional specifications, material, specifications, pipe ends, pipe fittings, pipe support.

Unit III

Valves–gate valve, globe valve, check valve, ball valve, plug valve, butterfly valve, control valve, pressure relief valve, valve codes and standard, valve size, pressure class rating.

Unit IV

Viscosity, Reynolds number, friction factor, Darcy Weisback friction factor, friction factor for laminar and turbulent flows, equivalent pipe length, hydraulic radius.

RECOMMENDED BOOKS

1. Piping and Pipeline Calculations Manual by J. Phillip Ellenberger
2. The fundamentals of piping design by Peter Smith.
3. Handbook of Air conditioning and refrigeration by Shan KWang, McGraw-hill international edition, Singapore.
4. Refrigeration and Air Conditioning by RS Khurmi.
5. ASHRAE handbook, 2002

BVRC 204: BASICS OF REFRIGERATION & AIR CONDITIONING

Semester	2					
Course code	BVRC 204					
Course title	Basics of Refrigeration &Air Conditioning (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

Unit-I

Introduction: Its meaning and application, unit of refrigeration; various methods of refrigeration.

Unit-II

Refrigeration Systems: Refrigeration Cycles: Refrigeration, carnot cycle of refrigeration (ideal cycle), Bell-Coleman cycle of refrigeration, their COP Representation of these cycles in P- V, T-S and P-H diagrams. No numerical problems.

Unit–III

Introduction of Air-Conditioning: Its meaning and general application. Psychrometry: Definition, Composition of air, Daltons law of partial pressure, Gas and Vapour mixture, dry air, wet air, Saturated air, Dry bulb temperature, Wet bulb temperature, Wet bulb depression, Dew point, Dew point depression, Specific humidity, relative humidity, absolute humidity, enthalpy of air.

Unit-IV

Psychometry:

Specific humidity, Degree of saturation, Relative humidity, Absolute humidity, Humid specific volume and humid specific heat, Enthalpy of moist air.

Unit-V

Vapour Absorption Refrigeration System:

Vapour absorption refrigeration system, its principles, different types Vapour absorption refrigeration system.

TEXT BOOKS:

1. Refrigeration and Air-Conditioning,Domkundwar, Arora & Domkundwar, Dhanpat Rai and Co.
2. Refrigeration and Conditioning, Manohar Prasad, New Age International Publishers
3. Refrigeration and Air Conditioning, R.K. Rajput, S. Chand Publishing
4. Refrigeration and Air Conditioning, R.S. Khurmi and J.K. Gupta, S. Chand Publishing
5. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayan, Tata McGraw Hill
6. Refrigeration and Conditioning, C.P. Arora, McGraw Hill Education

BVRC 205: REFRIGIRATION & AIR-CONDITIONING LAB.-I

Semester	2					
Course code	BVRC 205					
Course title	Refrigeration & Air-conditioning Lab - I (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	2	60	40	1

LIST OF EXPERIMENTS

1. To Study the vapour compression System.
2. Operation of a vapour compression system using refrigeration trainer.
3. To study various components of an air-conditioner.
4. Operation of an air-conditioner, using air-conditioner trainer.
5. To study centralized air- conditioning plant.
6. To Study the various control devices e.g. Thermostat, Relays & dryers etc.

BVRC 206: PROJECT-II

Semester	2					
Course code	BVRC 206					
Course title	Project-II (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	#	60	40	10

Candidates will make a project related to air-conditioning. After making the project, he/she is supposed to have practical knowledge about different parts used in different air-conditioning units (domestic & commercial); work related to dismantling & assembly of various parts used in different air-conditioning units.

A detailed report will have to be submitted after making the project.

#Concerned Head of Department will assign Project-II to faculty member(s) as coordinator with Load of 2 hrs/week.

Third Semester
(Refrigeration and Air Conditioning)

BVRC 301: ENVIRONMENTAL STUDIES

Semester	3					
Course code	BVRC 301					
Course title	Environmental Studies (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. **The Multidisciplinary Nature of Environmental Studies**:
   Definition, scope & Need for public awareness.

2. **Natural Resources and Associated Problems**:
   Natural Resources, Forest Resources, Water Resources: Use and exploitation; Land Recourses: Land as a resource, land degradation.

3. **Environmental Ethics**:
   Issues and possible solutions.

4. **Water Conservation**:
   Rain water harvesting, water shed management.

5. **Urban Problems Related to Energy:**
   From unsustainable to sustainable development.

6. **Social Issues and Environment**:
   Environmental Protection Act, Wasteland reclamation. Air (prevention and Control of Pollution) Act, Water (prevention and Control of Pollution) Act.

7. **Public Awareness**:
   Issues involved in enforcement of environmental legislation.

REFERENCES BOOKS:

1. Agarwal, K.C.2001. Environmental Biology, Nidhi Publications Ltd.Bikaner.
2. Bharucha, E.2005. Text book of Environmental Studies, Universities Press, Hyderabad.
3. Down to Earth, Centre for Science and Environment, New Delhi.
4. Jadhav,H.& Bhosale, V.M.1995.Environmental Protection and Laws. Himalaya Publication

BVRC 302: REFRIGERATION SYSTEMS

Semester	3					
Course code	BVRC 302					
Course title	Refrigeration Systems (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	4	1	0	40	60	5

1. **History and Fundamentals of Refrigeration:**
   Temperature, pressure measurements, Refrigeration systems and terms, symbols of various refrigeration Devices.

2. **Ideal Basic Refrigeration Cycle:**
   Thermodynamic analysis of cycle

3. **Refrigeration Plant main components:**
   Compressor, Condenser, Expansion valve, Evaporation system, (Practical significance)

4. **Installation of Refrigeration Equipment:**
   Maintenance, Service and Repair of Refrigeration Equipment, Refrigerant Safety Logs

5. **Refrigeration plants**
   Ice Plant, Cold storage, Chilling plant

RECOMMENDED BOOKS

1. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpat Rai and sons, Delhi
2. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
3. Refrigeration and Air Conditioning by R.S. Khurmi, S.Chand & Company, New Delhi
4. Refrigeration and Air Conditioning by R.K.Rajput, S. Chand Publishing, New Delhi

BVRC 303: INDUSTRIAL MANAGEMENT

Semester	3					
Course code	BVRC 303					
Course title	Industrial Management (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. **Basics of Management:**
   Management – Definition, Henry-Fayol's principles of management, Business organization Types, Functions of Management, Maslow's Theory of Motivation, Process of Communication Barriers for effective communication. Economics related to engineering, costing and accountings, operation & research.

2. **Materials Management:**
   Definition, functions & Objectives. Purchase procedure – Comparative statement, purchase order. Inventory Management – Definition, functions of Inventory Control.

3. **Plant Maintenance:**

   Plant maintenance – Definition, Types of Maintenance-Preventive maintenance- Break down Maintenance-Advantages and disadvantages-Total Productive Maintenance-Meaning benefits of TPM.Supply chain management, the management of flow of goods & services between business & location.

4. **Social Issues & Environment:**
   Environment-Definition and scope; Solid waste management: causes, effects and control measures; Climate change: global warming, acid rain, ozone layer depletion.

TEXT/ REFERENCE BOOKS:

1. T.R.Banga & SC Sharma. Industrial Organization and Engineering Economics; Khanna. Publishers
2. K.K.Ahuja. Industrial management and organizational behavior.
3. O.P.Khanna; Industrial management and engineering economics.
4. K.Aswathappa and Sreedhar Bhatt. Production and operations management, Himalaya publishers.

BVRC 304: METROLOGY AND MEASURING INSTRUMENTS

Semester	3					
Course code	BVRC 304					
Course title	Metrology and Measuring Instruments (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. Introduction to Metrology:

Need, Elements, Work piece, Instruments, Environment and their effect on Precision and Accuracy, Errors: Errors in Measurements, Types, Control, Types of standards, Limits, fits and tolerances. Hole Basis & Shaft Basis system. Transducers. In linear measurement V-Blocks, Calipers, Vernier calipers

2. Linear Measuring Instruments:

Evolution,Types,Classification,Limitgauges,gaugedesignterminology,procedure,concepts of interchange ability and selective assembly, Angular measuring instruments; Types, Bevel protractor, clinometers, angle gauges, spirit levels, sine bar, Angle alignment telescope, Autocollimator and applications.

3. Basic Concept of Lasers:

Advantages of lasers, laser Interferometers, types, DC and AC Lasers interferometer and applications, Straightness, Alignment. Basic concept of CMM: Types of CMM, Constructional features, Probes, Accessories, Software and applications, Basic concepts of Machine Vision System, Element and applications.

4. Principles and Methods of Straightness:

Flatness measurement, thread measurement, gear measurement, surface finish measurement, Roundness measurement and applications. Metrology of gears & screw threads.

REFERENCES BOOKS:

1. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K."Engineering Metrology", Khanna Publishers, 2009.
3. Vinay Kulkarni, Metrology and Measurement, Tata McGrawHill
4. N.V.Raghavendra, Engineering Metrology and Measurement

BVRC 305: METROLOGY AND MEASURING LAB

Semester	3					
Course code	BVRC 305					
Course title	Metrology and Measuring Lab (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	2	60	40	1

LIST OF EXPERIMENTS

1. Measurement of angle with the help of sine bar.
2. Use of comparators for measurement
3. To measure the pitch, angle and form of thread of a screw thread using profile projector
4. Use of linear measuring instrument such as Vernier caliper and micrometer.
5. Use of height gauge and Vernier calipers.
6. Measurement of Thread Parameter by using toolmaker's microscope.
7. Measurement of surface roughness of a surface.
8. Use of feeler, wire, radius and fillet gauges for checking of standard parameters.

BVRC 306: REFRIGERATION & AIR CONDITIONING LAB-II

Semester	3					
Course code	BVRC 306					
Course title	Refrigeration & Air-Conditioning Lab-II (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	4	60	40	2

LIST OF EXPERIMENTS

1. To change refrigerant into service cylinder from storage cylinder.
2. To evaluate the refrigeration system.
3. To pump down the system.
4. To purge air from the system.
5. To locate the leaks in a system.
6. To charge the system.
7. To check the oil level in the compressor.
8. Tracing the common faults in R&A.C units and their remedies.

BVRC 307: PROJECT III

Semester	3					
Course code	BVRC 307					
Course title	Project III (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	#	60	40	10

Candidates will make a project related to maintenance of refrigeration. After making the project, he/she is supposed to have practical knowledge about different parts used in different refrigeration units (domestic & commercial); maintenance related activities of a refrigeration unit. A detailed report will have to be submitted after making the project.

#Concerned Head of Department will assign Project-III to faculty member(s) as Coordinator with Load of 2 hrs/week.

Fourth Semester
(Refrigeration and Air Conditioning)

BVRC 401: AIR CONDITIONING SYSTEMS

Semester	4					
Course code	BVRC 401					
Course title	Air Conditioning Systems (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. **Introduction:**
   Meaning of air conditioning, comfort air conditioning, industrial air conditioning. Compressors: Introduction, Types Hermetic, Semi Hermetic open compressors. Reciprocating, Centrifugal & Rotary Compressors: construction features and volumetric Efficiencies. Multi-cylinder. Compression & Capacity control. Alternatives refrigerants for the refrigeration & air-conditioning

2. **Compressor Lubrication:**
   Methods of Lubrication & the properties of a Lubricating oil Identifications of sources of problem in operation Value failure, Shaft Seals 3- way Values cylinder to head gaskets.

3. **Condensers:**
   Definition, Basic Principle, Types of Condenser: Air cooled Condenser, Water-cooled Condenser, Evaporative Condenser and their Constructional features. Comparison between Waters & Air cooled condenser & their Advantages & disadvantages.

4. **Expansion Devices:**
   Types of expansion devices

5. **Evaporators:**
   Types of Evaporators, heat transfer in evaporators

6. **Cooling Load:**
   Cooling Load and heat gains, cooling load for a whole building

RECOMMENDED BOOKS

1. A course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar, Dhanpat rai and sons, Delhi
2. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
3. Refrigeration and Air Conditioning by R.S. Khurmi,S.Chand & Company, New Delhi
4. Refrigeration and Air Conditioning by R.K.Rajput,S.Chand Publishing,NewDelhi

BVRC 402: ENGINEERING MATERIALS

Semester	4					
Course code	BVRC 402					
Course title	Engineering Materials (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. ELECTRICAL ENGINEERING MATERIALS:

Conducting Materials: Properties of good conducting materials, Brief idea about conductivity & Resistivity.

Insulating Materials: (a) Plastic insulating materials-definition and classification, thermosetting and thermoplastic materials, their applications and commercial names & uses in industry. (b) Various insulating materials-mica asbestos, ceramic materials, glass, their properties and applications.

Semiconductor Materials: Characteristics and applications of semiconductor materials

Non-Metallic Materials-Timber. Preservation of timber, Defects of timber, Surface treatment

Miscellaneous Materials: Important properties, characteristics and use of the following materials:

Abrasives, Asbestos, Cork, Mica, Refractory

2. MECHANICAL ENGINEERING MATERIALS:

Non-Ferrous Metals: Aluminum, Zinc, Copper, Silver-Trade names; Physical, mechanical and electrical properties and use.

Base metal with principal alloy in elements- Aluminum Alloys, Copper Alloys, Nickel Alloys

3. CIVIL ENGINEERING MATERIALS:

General idea of raw materials, properties and uses of Bricks, lime, cement Foundation:(i) Bearing capacity of soil and its importance, need of foundation for machines (ii) Foundations for heavy, light and vibrating machines (iii) Concrete proportion, mixing w/c ratio, workability RCC and its use.

BOOKS RECOMMENDED:

1. Engineering Mechanics, M.P. Poonia & D.S. Bedi, Khanna Publishing House
2. Civil Engineering Construction Materials, S.K.Sharma,Khanna Publishing House
3. Engineering Materials: Dhanpat Rai &Sons
4. Electrical Engineering Materials: Madan Publishers

BVRC 403: REFRIGERANTS

Semester	4					
Course code	BVRC 403					
Course title	Refrigerants (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. **Introduction:**
   Refrigerants, cooling media and liquid absorbents, numbering of refrigerants.

2. **Classification and Properties of Refrigerants**:
   Requirement for refrigerant, classification-based on working principle, desirable properties of refrigerants- thermodynamic properties, safe working properties, physical properties etc. Refrigerant effect on global warming. Global warming potential of refrigerants

3. **Choice of Refrigerant**:
   Important refrigerants, secondary refrigerant, anti-freeze solution, selection of refrigerant for required purpose, Classification based on application of Refrigerant.

4. **Application of Refrigerants:**
   Refrigerant oils and applications, Properties and uses of commonly used refrigerant

RECOMMENDED BOOKS

1. A course in Refrigeration and Air Conditioning by S.C.Arora and S. Domkundwar, Dhanpat Rai and sons, Delhi
2. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
3. Refrigeration and Air Conditioning by R.S. Khurmi,S.Chand & Company,New Delhi
4. Refrigeration and Air Conditioning by R.K Rajput, S. Chand Publishing, New A course in Refrigeration and Air Conditioning by S.C.Arora and S. Domkundwar, Dhanpat rai and sons, Delhi

BVRC 404: REFRIGERATION & AIR CONDITIONING STANDARDS

Semester	4					
Course code	BVRC 404					
Course title	Refrigeration & Air conditioning Standards (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	2	1	0	40	60	3

1. Introduction:

Meaning of IS, need of IS, international classification of standards for refrigeration and air conditioning, various national and international standards for heating, ventilation and air conditioning.

2. Procedure of Standard Development:

Levels of standard, main standardization, organizations, i.e. ISO- international organization for standardization, IEC-international electro technical commission and others international and national organizations**.**

3. Existing Standards:

Main technical standards relevant to HCFC phase-out and low GWP (Global Warming Potential) alternatives, ISO, IEC, ECS (European Committee for Electrical Technical Standardization).

4. Adoption of International Standards at National Level:

National standardization bodies, national ozone units, accreditation bodies, national RAC associations, the process of adoption**.**

RECOMMENDED BOOKS

1. International Standards in Refrigeration and Air Conditioning, UNEP (United Nations Environment Program)
2. Refrigeration and Air Conditioning data book, New Age International Publication
3. Refrigerant Tables and Charts Including Air Conditioning Data CP Kothandaraman by New Age International Publication
4. Refrigeration and Air-Conditioning Data Book Domkundwar by Dhanpat Rai and Company

BVRC 405: REFRIGERATION & AIR-CONDITIONING EQUIPMENTS

Semester	4					
Course code	BVRC 405					
Course title	Refrigeration & Air-Conditioning Equipment (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	2	1	0	40	60	3

1. **Introduction:**

   Desired properties of ideal insulating material, factors effecting the thermal conductivity

2. **Types of Insulating Materials:**

   Reflective insulating blinds, laprock–a thermal acoustic and fire insulation, natural insulator, new transparent heat insulator, heat transfer through insulation used for A.C.

3. **Specialist Tools and Accessories:**

   Flexible charging line, bending springs, pipe tube cutter, fin combs, soldering and brazing equipment's, Vacuum pump, charging cylinders, electric test lamps, jumper lead, welding goggles

4. **Cables and Wiring:**

   Cryocables, economics of cryocables, A.C. super conducting cables, liquid N2 cooled cables, Liquid H2 cooled cables, super magnet, electric generator, minimal insulated cables, installing cables

5. **Component Material:**

   Refrigeration component material, duct material, material used in evaporator, compressor and condenser.

Recommended Books

1. International Standards in Refrigeration and Air Conditioning, UNEP (United Nations Environment Program)
2. Refrigeration and Air Conditioning data book, Manohar Prasad by New Age International Publication
3. Refrigerant Tables and Charts Including Air Conditioning Data C P Kothandaraman by New Age International Publication
4. Refrigeration and Air-Conditioning Data Book Domkundwar byDhanpat Rai and Company

BVRC 406: COOLING TOWERS & AIR HANDLING UNITS

Semester	4					
Course code	BVRC 406					
Course title	Cooling Towers &Air Handling Units (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. **Cooling Towers**

   Brief rundown of how cooling towers operate, including knowledge about circulation of hot water, distribution of water through cooling tower, airflow, importance of heat exchangers for a cooling tower operation, lost water make-up etc.

2. **Maintenance of Cooling Towers**

   Introduction of regular inspections, Cleaning etc.

3. **Material used in Cooling Towers**

   Basic knowledge of material used for Structure, Fill Media, distribution System, fans, Drift Eliminators, basins, louvers etc.

4. **Maintenance of pH Level in Cooling Towers**

   Basic knowledge about Regular Monitoring, Adjusting pH Levels, Buffering Agents, corrosion Inhibitors, Cleaning and De-scaling etc.

5. **Basic Knowledge of operation & Maintenance of Air Handling Units**

   Brief introduction about Air Intake, Filtering, Pre-Heating or Pre-Cooling, Humidification and Dehumidification, Fan Operation etc.

6. **Types of Cooling Towers**

   Introduction of Natural Draft Cooling Tower, Induced Draft Cooling Tower, Forced Draft Cooling Tower, counter flow and cross flow cooling tower.

RECOMMENDED BOOKS

1. A course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar, Dhanpat rai and sons, Delhi
2. Modern Refrigeration and Air Conditioning by Andrew D. Althouse, Carl h. Turnquist and Alfred F. Bracciano, The goodheart-willcox company, INC
3. Refrigeration and Air Conditioning by R.S. Khurmi, S.Chand & Company, New Delhi
4. Refrigeration and Air Conditioning by R.K Rajput, S. Chand Publishing,

BVRC 407: REFRIGERATION & AIR CONDITIONING LAB -III

Semester	4					
Course code	BVRC 407					
Course title	Refrigeration & Air Conditioning Lab -III (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	2	60	40	1

LIST OF EXPERIMENTS

1. To study basic components of air-conditioning system using test rig.
2. Experiment on air-conditioning test rig & calculation of various performance parameters.
3. To study the room air conditioner using open air-conditioner system of lab.
4. To study cooling and dehumidifying coils and apparatus dew point of coil.
5. To study heating coils and its bye-pass factor.
6. To find out the cooling load for given large building.
7. To Study the range of psychrometric processes with air washers equipment.

BVRC 408: PROJECT- IV

Semester	4					
Course code	BVRC 408					
Course title	Project-IV (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	#	60	40	10

Candidates will make a project related to maintenance of air-conditioning. After making the project, he/she is supposed to have practical knowledge about different parts used in different air-conditioning units (domestic & commercial); maintenance related activities of air-conditioning unit. A detailed report will have to be submitted after making the project.

#Concerned Head of Department will assign Project-IV to faculty member(s) as coordinator with Load of 2 hrs/week.

Fifth Semester
(Refrigeration and Air Conditioning)

BVRC 501: SAFETY IN REFRIGERATION AND AIR CONDITIONING

Semester	5					
Course code	BVRC 501					
Course title	Safety in Refrigeration and Air Conditioning (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	4	1	0	40	60	5

1. **Introduction to Industrial Safety:**

   Need for safety, safety legislation: acts and rules, safety standards and codes; accident sequence theory, causes of accidents, accident prevention and control techniques, plant safety inspections.

2. **Safety Components:**

   Safety on the Job: Personal safety, protective clothing and equipment, harmful Substances, safe work, practices, safety when working with electricity, refrigeration safety.

3. **Types of Accidents:**

   Safety for RAC Engineers: Types of accident, physical injuries from mechanical causes, use of tools and handling precautions.

4. **Precautions against Injuries in RAC:**

   Injuries in RAC and Precaution: Refrigerant cylinder, corrosion, refrigerants and other gases Construction materials, fire fighting precautions, breathing, toxic gases, and precaution for the same.

TEXT BOOKS:

1. Air conditioning Systems principles, equipments and Services", Joseph Moravek, PrenticeHall
2. "HVAC Handbook", Part I and II, ISHRAE
3. "Industrial refrigeration Hand Book", Wilbert F. Stoecker

BVRC 502: HUMAN RESOURCE MANAGEMENT

Semester	5					
Course code	BVRC 502					
Course title	Human Resource Management (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. Introduction:

Introduction to Human Resource Management: Concept, Definition, Objectives, Nature and Scope ofHRM - Functions of HRM – Evolution of human resource management - Role and structure of Human Resource Function in organizations.

2. Human Resource Management Approaches:

Phases of human resource Management- The importance of the human factor – Competitive challenges of HRM – HRM Models – Roles and responsibilities of HR department.

3. Human Resource Planning:

Human Resource Planning: Personnel Policy - Characteristics - Role of human resource manager, Human resource policies – Need, Scope and Process – Job analysis – Job description – Jobspecification- Succession Planning.

4. Recruitment and Selection Process:

Employment planning and fore casting Sources of recruitment- internal Vs. External; Domestic Vs. Global sources Selection process Building employee commitment: Promotion from within - Sources, Developing and Using application forms – IT and recruiting on the internet.

TEXT BOOKS:

1. Venkataraman & Srivastava, Personnel Management & Human Resources
2. Arun Monappa, Industrial Relations
3. Yodder & Standohar, Personnel Management & Industrial Relations
4. R.S. Dwivedi, Manpower Management

BVRC 503: ECONOMICS FOR ENGINEERS

Semester	5					
Course code	BVRC 503					
Course title	Economics for Engineers (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. Demand Functions:

Demand function; Law of demand; Determinants and exceptions to the law of demand; Price elasticity of demand and its importance; Income elasticity of demand; Cross price elasticity of demand; Determinants of price elasticity, Market mechanism; equilibrium and its stability.

2. Production Functions:

Production function - short run & long run; Short run - theory of production; Long run- Returns to scale; Theory of costs – short run and long run cost curves Economic Concept of profit.

3. Investment & Project Management:

Concept of investment Evaluating Capital Projects; (a) Payback Period Method (b) Net Present Value Method (c) Internal Rate of Return Method.

4. Planning:

Mixed Economy and relevance of planning; Globalization; Gross Domestic Product and its growth; Inflation; Business Cycle and real estate business in India; Foreign Direct Investment.

TEXT BOOKS:

1. Samuelson & Nordhaus, Economics, Sixteenth Edition, Tata McGraw Hills.
2. Mankiw, Gregory N., Principles of Economics Sixth Edition.
3. A.N. Agarwal, Indian Economy: Problem of Development and Planning, New AgeInternational.

BVRC 504: ENTREPRENEURSHIP

Semester	5					
Course code	BVRC 504					
Course title	Entrepreneurship (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	3	1	0	40	60	4

1. **Introduction:**
   Definition, aim, Conceptual definition of entrepreneurs and entrepreneurship, Historical development of entrepreneurship, Entrepreneurial practice.

2. **Small Businesses:**
   The importance of small business, Entrepreneurial economy, Entrepreneurship and Economic Development, Type of Entrepreneurship, Entrepreneur and small business, Features and types of businesses and entrepreneurs.

3. **Role of Entrepreneurship:**
   The role of entrepreneurship in economic development, Terms of entrepreneurship, Innovation and entrepreneurship, Entrepreneurship and small business, The life cycle of a small company, Forms ofentrepreneurial organization, Sources of capital.

4. **Entrepreneurial Projects:**
   Entrepreneurial project: an entrepreneurial venture and entrepreneurial development chain. Defining the business concept, Writing a business plan, Basics of Venture Marketing, Fundamentals of entrepreneurial management, Technical and technological analysis of entrepreneurial projects.

TEXT BOOKS:

1. Entrepreneurship Development, By: Jagroop Singh & Ankur Mahajan, Kalayani Publishers.
2. Entrepreneurship Development & Management, By: RK Singhal, S.K. Kataria andSons
3. Entrepreneurship Development & Management, By: Vasant Desai & Kulveen Kaur, Himalayan Publishing House.

REFERENCE BOOKS:

1. Entrepreneurship Development, By: Khanka S.S., S. Chand Publishers.

BVRC 505: MAINTENANCE OF REFRIGERATION AND AIR CONDITIONING SYSTEMS

Semester	5					
Course code	BVRC 505					
Course title	Maintenance of Refrigeration and Air Conditioning Systems (Theory)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	4	1	0	40	60	5

Unit I

RAC Tools: Engineering hand tools: spanners, screwdrivers, pliers, hammers, brazing, welding, flaring tool, tube bender, wood saws, electrical hand drill, sheet metal snips, Allen keys pop riveter, chisels, pulley extractors, Center punch, wire brush, drill bits, oil can.

Unit II

Measuring Equipments: steel tape measure, feeler gauge, Caliper, micrometer, engineers levels, pocket type of thermometer, sling psychomotor, system analyzers, temperature analyzers, electronicleak detector, voltmeter, clamp-on ammeter.

Unit III

Specialist Tools and Accessories: flexible charging line, bending springs, pipe tube cutter, fin combs, soldering and brazing equipments, Vacuum pump, charging cylinders, electric test lamps, jumper lead, welding goggles.

Unit IV

Pipe installation work: pumping down the system, purging the system, starting the plant.

Unit V

Refrigerant Handling: Using a system analyzer, transferring and handling liquid refrigerant.

TEXT BOOKS:

1. Refrigeration & Air-Conditioning, Domkundwar,Arora and Domkundwar, Dhanpat Rai & Co.
2. Refrigeration and Conditioning, Manohar Prasad, New Age International Publishers
3. Refrigeration and Air Conditioning, R.K. Rajput, S. Chand Publishing
4. Refrigeration and Air Conditioning, R.S. Khurmi and J.K. Gupta, S. Chand Publishing
5. Basic Refrigeration and Air Conditioning, P. N. Ananthanarayan, Tata McGraw Hill
6. Refrigeration and Conditioning, C.P. Arora, McGraw Hill Education

REFERENCE BOOKS:

1. ASHRAE Handbook, Fundamentals, 2013
2. Carrier Handbook of Air Conditioning System Design, 2017
3. Principles of Refrigeration, Roy J. Dossat, Wiley Eastern Limited
4. Air Conditioning Applications and Design, W. P. Jones, Elsevier
5. Refrigeration and Conditioning, W.F. Stoecker, McGraw Hill
6. Refrigeration and Conditioning, Richard Charles Jordan, Gayle B. Priester, Prentice-Hall

BVRC 506: REFRIGERATION AND AIR CONDITIONING LAB - IV

Semester	5					
Course code	BVRC 506					
Course title	Refrigeration and Air Conditioning Lab - IV (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	4	60	40	2

LIST OF EXPERIMENTS

1. Leak detection in refrigeration system by different methods.
2. Air removal and charging of a refrigeration unit.
3. Testing of a refrigeration system to find out: (a) Refrigerating capacity (b) C.O.P.
4. Determination of psychrometric properties of air with the help of a sling psychrometer and aspiration psychrometer.
5. Determination of bye pass factor of a cooling coil.
6. Determination of humidifying efficiency of a evaporative cooler.
7. Determination of cooling load for a specified situation.
8. Study of the following system by visit: (a) Ice Plant (b) Cold storage plant (c) Control air-conditioning system.

BVRC 507: PROJECT V

Semester	5					
Course code	BVRC 507					
Course title	Project-V (Practical)					
Scheme and Credits	L	T	P	Internal Marks	External Marks	Credits
	0	0	#	60	40	10

Candidates will make a project related to maintenance of refrigeration. After making the project, he/she is supposed to have practical knowledge about different parts used in different refrigerating units (domestic & commercial); maintenance related activities of air-conditioning unit. A detailed report will have to be submitted after making the project.

#Concerned Head of Department will assign Project to faculty member(s) as coordinator with Load of 2 hrs/week.