

Bachelor of Vocation (B. Voc.) (Refrigeration & Air-conditioning)

B. Voc. (Refrigeration & Air-conditioning)

Duration of course* : 3 years

Eligibility : +2 (any stream)

***Exit Options**

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

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 3 years	Bachelor of Vocation (B. Voc.)

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								
BVRAC-21101	Fundamentals of Computers	3	1	-	25	75	100	4
BVRAC-21102	Basic Electrical & Electronics Engineering	3	1	-	25	75	100	4
BVRAC-21103	Computer Lab.	-	-	6	75	25	100	3
Skill Development Components								
BVRAC-21104	Thermodynamics in Refrigeration & Air Conditioning	3	1	-	25	75	100	4
BVRAC-21105	Basic Heat Transfer	3	1	-	25	75	100	4
BVRAC-21106	Heat Transfer Lab.	-	-	2	75	25	100	1
BVRAC-21107	Project –I #	-	-	-	150	50	200	10
Total		12	4	8	400	400	800	30

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

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-21201	Communication Skills in English	3	1	-	25	75	100	4
BVRAC-21201	Workshop Technology	3	1	-	25	75	100	4
BVRAC-21202	Workshop Practice	-	-	6	75	25	100	3
Skill Development Components								
BVRAC-21203	RAC piping system	3	1	-	25	75	100	4
BVRAC-21204	Basics of Refrigeration & Air Conditioning-I	3	1	-	25	75	100	4
BVRAC-21205	RAC Lab.-I	-	-	2	75	25	100	1
BVRAC-21206	Project-II #	-	-	-	150	50	200	10
Total		12	4	8	400	400	800	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								
BVRAC-21301	Environmental Studies	3	1	-	25	75	100	4
BVRAC-21302	Fundamentals of Refrigeration	4	1	-	25	75	100	5
BVRAC-21303	Industrial Management	3	1	-	25	75	100	4
Skill Development Components								
BVRAC-21304	Metrology and Measuring Instruments	3	1	-	25	75	100	4
BVRAC-21305	Metrology and Measuring Lab.	-	-	2	75	25	100	1
BVRAC-21306	Refrigeration Lab.-II	-	-	4	75	25	100	2
BVRAC-21307	Project-III #	-	-	-	150	50	200	10
	Total	13	4	6	400	400	800	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								
BVRAC-21401	Fundamentals of Air-conditioning	3	1	-	25	75	100	4
BVRAC-21402	Engineering Materials	3	1	-	25	75	100	4
BVRAC-21403	Refrigerants	3	1	-	25	75	100	4
Skill Development Components								
Elective -I (Anyone from BVRAC-21404 and BVRAC-21405)								
BVRAC-21404	RAC Standards	2	1	-	25	75	100	3
BVRAC-21405	RAC Equipment	2	1	-	25	75	100	3
BVRAC-21406	Cooling Towers & AHU	3	1	-	25	75	100	4
BVRAC-21407	Air-Conditioning Lab.-II	-	-	2	75	25	100	1
BVRAC-21408	Project-IV #	-	-	-	150	50	200	10
Total		16	6	2	350	450	800	30

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

For Batches 2021 & Onwards
SBSSU, Gurdaspur, Recognized under Section 2(f) of UGC Act, 1956

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								
BVRAC-21501	Safety in RAC	4	1	-	25	75	100	5
Elective -II (Anyone from BVRAC-21502 and BVRAC-21503)								
BVRAC-21502	Human Resource Management	3	1	-	25	75	100	4
BVRAC-21503	Economics for Engineers	3	1	-	25	75	100	4
BVRAC-21504	Entrepreneurship	3	1	-	25	75	100	4
Skill Development Components								
BVRAC-21505	Maintenance of Refrigeration & Air-conditioning systems	4	1	-	25	75	100	5
BVRAC-21506	Air-Conditioning Lab.-III	-	-	4	75	25	100	2
BVRAC-21507	Project-V #	-	-	-	150	50	100	10
Total		14	4	04	325	375	700	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		
BVRAC-21601	Industrial Training	-	-	-	250	450	700	30
Total		-	-	-	250	450	700	30

First Semester

Refrigeration and Air conditioning

Fundamentals of Computers (BVRAC-21101)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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
- Parts of Windows Screen (Desktop icons, Windows (Application Window, 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 a Table, Operations on Table in MS Word

TEXT BOOKS:

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

REFERENCES BOOKS:

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

Basic Electrical & Electronics Engineering (BVRAC-21102)

L-T-P

3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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, Kirchoff'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.

Recommended Books:

1. Fundamental of Electrical and Electronic Engineering by B.L Theraja; S. Chand and Company, New Delhi.
2. Basic Electronic and Electrical Engineering by Bhattacharya SK, 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

Computer Lab. (BVRAC-21103)

L-T-P
0-0-6

Internal Marks: 75

External Marks: 25

Total Marks: 100

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

- MS Word and
- Window 10

Thermodynamics in Refrigeration & Air Conditioning (BVRAC-21104)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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.

List of 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

Basic Heat Transfer (BVRAC-21105)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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.

Heat Transfer Lab. (BVRAC-21106)

L-T-P
0-0-2

Internal Marks: 75

External Marks: 25

Total Marks: 100

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

Project - I (BVRAC-21107)

Internal Marks: 150

External Marks: 50

Total Marks: 200

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.

Second Semester

Refrigeration and Air conditioning

Communication Skills in English (BVHU-21201)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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 Book:

- Applying Communication Theory for Professional Life: A Practical Introduction by Dainton and Zelle
- Communication Skills: Sanjay Kumar and Pushap Lata
- On writing well: William Zinsser

Workshop Technology (BVRAC-21201)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

Introduction to workshop. Maintenance of workshop tools and machinery. Safety precautions. Usage of various gauges to measure length, mass, volume, speed, temperature and pressure, like: 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 Jeyapoovan; 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 S K Hajra, Choudhary and A K Chaoudhary.
4. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi

Workshop Practice (BVRAC-21202)

L-T-P
0-0-6

Internal Marks: 75
External Marks: 25
Total Marks: 100

To prepare jobs related to

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

RAC Piping System (BVRAC-21203)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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. Hand book of Air conditioning and refrigeration by Shan K Wang, McGraw-hill international edition, Singapore.
4. ASHRAE handbook, 2002

Basics of Refrigeration & Air Conditioning–I (BVRAC-21204)

L-T-P
3-1-0

Internal Marks: 25

External Marks: 75

Total Marks: 100

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, Dalton's 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

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, its principles, different types Vapour absorption refrigeration system.

RAC Lab.-I (BVRAC-21205)

L-T-P
0-0-2

Internal Marks: 75

External Marks: 25

Total Marks: 100

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.

Project - II (BVRAC-21206)

Internal Marks: 150

External Marks: 50

Total Marks: 200

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.