Quest for Excellence

MAHARASHTRA INSTITUTE OF TECHNOLOGY, AURANGABD

An Autonomous Institute Affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra (India)

Syllabus of Bachelor of Vocation

In

Refrigeration and Air Conditioning

Under Choice Based Credit System (CBCS)

Under Faculty of Science and Technology

(Effective from 2022-23 and onwards)

Curriculum for B. Voc Refrigeration and Air-conditioning

NSQF Level -5										Semester -I
Sr. No.	Course Code	Course Title	Credit	Contact Hr/Wk		Evaluation Scheme				ESE hour
				L	P	MSE	TA	ESE	Total	
Theory										
1.	VRA101	Basics of Refrigeration	3	3	-	10	15	25	50	1.5
2.	VRA102	Basics of Air Conditioning	3	3	-	10	15	25	50	1.5
3.	VRA103	Engineering Material	3	3	-	10	15	25	50	1.5
4.	VRA104	Soldering & De-Soldering of components and emergency actions	3	3	-	10	15	25	50	1.5
Lab/Practical										
5.	VRA121	Metrology and Measuring Instruments Lab	1.5	-	2	-	25	25	50	-
6.	VRA122	Heat Transfer Lab	1.5	-	2	-	25	25	50	-
On Job Training (OJT)/Qualification Packs*										
7.	VRA131	Field Technician-AC(ELE/Q3102)	15	-	7-8 weeks	--	50	150	200	-
	VRA132	Field Technician-Refrigeration (ELE/Q3103)								
	VRA133	Field Engineer-RACW (ELE/Q3105)								
*Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC										

NSQF Level -5										Semester -II
Sr. No.	Course Code	Course Title	Credit	Contact Hr/Wk		Evaluation Scheme				ESE hour
				L	P	MSE	TA	ESE	Total	
Theory										
1.	VRA151	Industrial Management	3	3	-	10	15	25	50	1.5
2.	VRA152	Total Quality Management	3	3	-	10	15	25	50	1.5
3.	VRA153	Entrepreneurship	3	3	-	10	15	25	50	1.5
4.	VRA154	Refrigeration & Air Conditioning Applications	3	3	-	10	15	25	50	1.5
Lab/Practical										
5.	VRA171	Basic Electrical and Electronics Lab	1.5	-	2	-	25	25	50	-
6.	VRA172	Refrigeration and Air-conditioning lab.	1.5	-	2	-	25	25	50	-
On Job Training (OJT)/Qualification Packs*										
7.	VRA181	One more QP to be opted from QPs mentioned in the level 5 first semester	15	-	7-8 weeks	--	50	150	200	-
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Curriculum for B. Voc Refrigeration and Air-conditioning

NSQF Level -6										Semester -I
Sr. No.	Course Code	Course Title	Credit	Contact Hr/Wk		Evaluation Scheme				ESE hour
				L	P	MSE	TA	ESE	Total	
Theory										
1.	VRA201	RAC Piping Systems- I	3	3	-	10	15	25	50	1.5
2.	VRA202	Refrigeration & Air-conditioning Material -I	3	3	-	10	15	25	50	1.5
3.	VRA203	Refrigerants	3	3	-	10	15	25	50	1.5
4.	VRA204	RAC Standards	3	3	-	10	15	25	50	1.5
Lab/Practical										
5.	VRA221	RAC Material Lab	1.5	-	2		25	25	50	-
6.	VRA222	RAC Systems Installation and its Maintenance Lab. -I	1.5	-	2		25	25	50	-
On Job Training (OJT)/Qualification Packs*										
7.	VRA231	Safety Tester – RACWO(ELE/Q3605)	15	-	7-8 weeks	--	50	150	200	-
	VRA232	Field Engineer– RACW(ELE/Q3105)								
	VRA233	Cold Storage TechnicianFIC/Q7004)								

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NSQF Level -6										Semester -II
Sr. No.	Course Code	Course Title	Credit	Contact Hr/Wk		Evaluation Scheme				ESE hour
				L	P	MSE	TA	ESE	Total	
Theory										
1.	VRA251	RAC Piping Systems-II	3	3	-	10	15	25	50	1.5
2.	VRA252	Refrigeration & Air-conditioning Material-II	3	3	-	10	15	25	50	1.5
3.	VRA253	RAC Maintenance-I	3	3	-	10	15	25	50	1.5
4.	VRA254	RAC Installation Techniques -I	3	3	-	10	15	25	50	1.5
Lab/Practical										
5.	VRA271	RAC Systems Installation and its Maintenance Lab. -II	1.5	-	2	-	25	25	50	-
6.	VRA272	RAC Piping Systems Lab	1.5	-	2	-	25	25	50	-
On Job Training (OJT)/Qualification Packs*										
7.	VRA281	One more QP to be opted from QPs mentioned in the level 6 first semester	15	-	7-8 weeks	--	50	150	200	-

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Curriculum for B. Voc Refrigeration and Air-conditioning

NSQF Level -7										Semester -I
Sr. No.	Course Code	Course Title	Credit	Contact Hr/Wk		Evaluation Scheme				ESE hour
				L	P	MSE	TA	ESE	Total	
Theory										
1.	VRA301	RAC Maintenance-II	3	3	-	10	15	25	50	1.5
2.	VRA302	RAC Installation Techniques-II	3	3	-	10	15	25	50	1.5
3.	VRA303	Automobile Airconditioning	3	3	-	10	15	25	50	1.5
4.	VRA304	Non-conventional Refrigerating System	3	3	-	10	15	25	50	1.5
Lab/Practical										
5.	VRA321	Automobile AC Lab.	1.5	-	2	-	25	25	50	-
6.	VRA322	AC components and Assembly Laboratory	1.5	-	2	-	25	25	50	-
On Job Training (OJT)/Qualification Packs*										
7.	VRA331	AC Specialist– Automobile (ASC/Q1416)	15	-	7-8 weeks	--	50	150	200	-
	VRA332	Assembly Operator(ELE/Q3501)								
	-	-								

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NSQF Level -7										Semester -II
Sr. No.	Course Code	Course Title	Credit	Contact Hr/Wk		Evaluation Scheme				ESE hour
				L	P	MSE	TA	ESE	Total	
Theory										
1.	VRA351	RAC Safety	3	3	-	10	15	25	50	1.5
2.	VRA352	Process Planning and Cost Estimation	3	3	-	10	15	25	50	1.5
Lab/Practical										
3.	VRA371	Project	9	-	4	-	100	100	200	-
On Job Training (OJT)/Qualification Packs*										
4.	VRA381	One more QP to be opted from QPs mentioned in the level 7 first semester	15	-	7-8 weeks	--	50	150	200	-

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA101: Basics of Refrigeration**	**Semester-I**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Total Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	Illustrate the fundamental principles and applications of refrigeration and air-conditioning system.
2.	Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems
3.	Present the properties, applications and environmental issues of different refrigerants

Unit	Course Content	Hours
Unit 1	**Introduction:** Itsmeaningandapplication,unitofrefrigeration;Variousmethodsofrefrigeration.	(02)
Unit 2	**Refrigeration Systems:** Refrigeration Cycles: Refrigeration, Carnot cycle of refrigeration (ideal cycle), Bell-Coleman cycle of refrigeration, their COP and Conditions for its highest value, Temperature limitations. Representation of these cycles, in P-V, T-S and P- H diagrams and also their flow diagrams, Simple numerical problems	(07)
Unit 3	**Vapour CompressionSystem:** Standard vapour compression cycle, wet and dry compression, Effect of sub cooling and super heating, Effect of temperature and pressure on COP of the cycle. Simple numerical problems with the help of P-H diagram. Concept of household refrigerator working onv apour compression cycle.	(07)
Unit 4	**Vapour Absorption System**: Cycle of operation, Construction and working of refrigerator based on this system. Simple numerical problems (Simple line diagram)	(07)
Unit 5	**Refrigerants:** Definition, classification & properties of few important refrigerants such as Ammonia, Sulphur-Di-Oxide (SO2) Carbon-Di-Oxide (CO2) Freon - 12 (F-12) F-11. Qualities of good refrigerants, secondary refrigerants	(07)

Reference Book

Sr. No.	Book	Author	Publisher
1	Refrigeration and Airconditioning	Sadhu singh	Khanna publishing house, New Delhi, First edition,2017
2.	Refrigeration and Airconditioning	A.S.Saro	Satya Prakashan, 1977
3.	Refrigeration and Airconditioning	R.S.Khurmi	Eurasia Publishing House, 2001

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Pattern of Question paper:

Question paper shall be based on all 5 units in the syllabus. Question number 1 is compulsory and shall be of objective nature (Multiple Choice Questions, fill in the blanks etc.) and should cover the entire syllabus. Students must solve any THREE questions from remaining five questions based on each unit.

For 25 Marks Paper:

1. Six questions.
2. Question no 1 is compulsory and should cover complete syllabus of the respective course for 10 marks.
3. Remaining five questions will be of 5 marks each.

Any Three questions of 5 marks each from remaining questions are to be solved.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA102: Basic of Air conditioning**	**Semester-I**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	Define various air properties and psychrometric processes
2.	Use the psychrometric chart for representing various psychrometric process.
3.	Illustrate the heat loads

Unit	Course Content	Hours
Unit 1	INTRODUCTION: Its meaning and generalapplication. Psychrometry: Definition, Composition of air, Daltons law of partial pressure, Gas and Vapour mixture, Dry and Wet bulb temperature, Wet bulb depression, Dew point, Dew point depression, Saturated air, UNIT 2	(06)
Unit 2	Specific humidity, Degree of saturation, Relative humidity, Absolute humidity, Humid specific volume and humid specific heat, Enthalpy of moist air,	(06)
Unit 3	Use of psychometric charts and tables, Sensible heating and cooling, Humidification and dehumidification and their methods, Simple numerical problems concerning above	(06)
Unit 4	HEAT LOAD: Brief idea of various types of heat loads, Sensible and latent heat loads. Sensible hat factor	(06)
Unit 5	ROOM AIR CONDITIONING: Brief idea of room air conditioning, Window types packaged air conditioner. Central air conditioning system, Round the year air conditioning	(06)

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	Refrigeration and Airconditioning	Sadhu singh	Khanna publishing house,New Delhi, First edition,2017
2.	Refrigeration and Airconditioning	A.S.Saro	Satya Prakashan, 1977
3.	Refrigeration and Airconditioning	R.S.Khurmi	Eurasia Publishing House, 2001

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA103: Engineering Material**	**Semester-I**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)
Students will be able to

1.	Explain various types of materials used in refrigeration and air-conditioning field
2.	Describe various properties of engineering materials
3.	Use of engineering material for different applications

Unit	Course Content	Hours
Unit 1	ELECTRICAL ENGINEERING MATERIALS Conducting Materials: Properties of good conducting materials, Brief idea about conductivity & Resistivity	(02)
Unit 2	(a) Insulating Materials: (a) Plastic insulating materials-definition and classification, thermo-setting and thermoplastic materials, their applications and commercial names & uses in industry. (b) Various insulating materials-mica asbestos, ceramic materials, glass, cotton, silk, jute, paper their properties and applications (B) Semiconductor Materials: Characteristics and applications of semiconductor materials	(07)
Unit 3	(A) Non-Metallic Materials-Timber. Preservation of timber, Defects of timber, Surface treatment, Plywood, Hard Board, Batten Board, Veneer board, units of purchase (B) Miscellaneous Materials: Important properties, characteristics and use of the following materials: Abrasives, Asbestos, Celluloid, Cork, Mica, Refractory	(07)
Unit 4	Mechanical Engineering Materials Non-Ferrous Metals: Aluminium, Zinc, Copper, Tin, Silver, Lead - Trade names; Physical, mechanical, and electrical properties and use (ii) Base metal with principal alloying elements - Aluminium Alloys, Copper Alloys, Nickel Alloys, Bearing Metals-Lead base alloys, Tin base alloys, (White metals or babbitt metals), Copper base alloys.	(07)
Unit 5	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.	(07)

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	Engineering Mechanics,	M.P.	Khanna Publishing House

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

Pattern of Question paper:

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For 25 Marks Paper:

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Any Three questions of 5 marks each from remaining questions are to be solved.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA104:Soldering &De-Soldering of Components and Emergency Actions**	**Semester-I**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	Explain varies types of soldering and de soldering types
2.	Describe the types of PCB and its components
3.	Use of soldering tools

Unit	Course Content	Hours
Unit 1	Soldering Tools: Different types of soldering guns related to temperature and wattages, types of tips, solder materials and their grading	(06)
Unit 2	Soldering and De-soldering stations: Soldering and De soldering stations and their specifications, preparting components for soldering	(06)
Unit 3	PCB: PCB applications, types of PCB, soldering basic components on PCB	(06)
Unit 4	De soldering tools: De soldering basic components, safety precautions while soldering and de soldering, check for cold continuity of PCB	(06)
Unit 5	Identification of faults Identifications of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards, join the broken PCB track and test, De soldering using pump and wick , introduction of SMD components	(06)

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	PCB design for Real-world EMI control	Bruce R. Archambeau lt and James Drewniak	Springer Science
2.	Complete PCB design using Orcad capture and layout	Kraig Mitzner	Newnes Pub
3.			

Pattern of Question paper:

Question paper shall be based on all 5 units in the syllabus. Question number 1 is compulsory and shall be of objective nature (Multiple Choice Questions, fill in the blanks etc.) and should

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cover the entire syllabus. Students must solve any THREE questions from remaining five questions based on each unit.

For 25 Marks Paper:

1. Six questions.
2. Question no 1 is compulsory and should cover complete syllabus of the respective course for 10 marks.
3. Remaining five questions will be of 5 marks each.

Any Three questions of 5 marks each from remaining questions are to be solved.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level -5	**VRA121:Metrology and Measurements Lab**	**Semester-I**

Teaching Scheme		Examination Scheme	
Practical	02Hours/week	TA	25 Marks
Credits	1.5	ESE/PE	25 Marks

Sr.No.	List of Experiments (Any Five)
1	Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
2	Study and sketch of various types of optical projectors.
3	Study and sketch of various types of comparators and use them for comparing length of given piece.
4	To measure the diameter of a hole with the help of precision balls.
5	To measure external and internal taper with the help of taper gauges, precision rollers.
6	To test the square-ness of a component with auto-collimeter.
7	To measure the pitch, angle and form of thread of a screw.
8	To measure the geometry of a gear having involute profile.
9	To measure the straightness of the edge of a component with the help of auto-collimeter.
10	To measure the length, breadth, thickness, depth, height with micrometer.
11	To measure the length, breadth, thickness, depth, height, with height gauge and Vernier calipers.
12	Calibration of Vernier calipers/micrometers

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level -5	**VRA122:Heat Transfer Lab**	**Semester-I**

Teaching Scheme		Examination Scheme	
Practical	02 Hours/week	TA	25 Marks
Credits	1.5	ESE/PE	25 Marks

Sr.No.	List of Experiments (Any Five)
1	Determination of Thermal conductivity of insulation powder
2	Determination of overall heat transfer coefficient of Composite Wall
3	Determination of overall heat transfer coefficient of Lagged Pipe
4	Determination of Thermal Conductivity of given Metal Rod
5	Determination of heat transfer coefficient of Pin-Fin (Natural and Forced Convection)
6	Determination of heat transfer coefficient of Natural Convection
7	Determination of heat transfer coefficient of Forced Convection.
8	Determination of Stefan Boltzman Constant
9	Determination of Emissivity of test plate

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

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NSQF Level -5	**On Job Training/Qualification Packs***	**Semester-I**

Teaching Scheme		Examination Scheme	
Practical	7-8 weekS	TA	50 Marks
Credits	15	ESE/PE	150 Marks

VRA131	Field Technician-AC(ELE/Q3102)
VRA132	Field Technician-Refrigeration(ELE/Q3103)
VRA133	Field Engineer-RACW(ELE/Q3105)

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA151:Industrial Management**	**Semester-II**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	Explain principle of management
2.	Design organization structure
3.	Apply various quality control techniques

Unit	Course Content	Hours
Unit 1	Introduction: Growth of industry, The management of men, materials and machines, the art of management, Sources of capital- industrial individual enterprise, private partnership and private Ltd. Co., Joint Stock Co. shares, debentures, financial agencies and their role in promoting industries. Break even analysis.	(06)
Unit 2	Private sector and public sector: Public sector enterprise, merits and demerits of public sector industry and private sector industry, Line, staff and functional organizations, reasons for the choice of various types of organization, functions of different departments, viz. stores, purchase and sales departments relationship between individual departments	(06)
Unit 3	Wages & incentives: Definition of wages, real wage and nominal wage, systems of wage payment, incentives, financial and non - financial incentives, Essentials of a good wage plan, essentials of a good incentive scheme. Introduction toelements of cost & indirect expenses, Material cost, labour cost, fixed and variable overheads, components of cost, selling price, Factory expenses, administrative expenses, selling & distribution expenses, depreciation, obsolescence, interest on capital, Idleness, Repair and maintenance.	(06)
Unit 4	Labour, industrial & tax laws: Evolution of industrial law, factory act, workmen compensation act, payment of wages act, employee's state insurance act, Industrial dispute act. Role of technician in industry: Position of technician in various engineering departments, Role of a supervisor in industry, Foremanship, duties and qualities of a good foreman	(06)
Unit 5	Material management: Introduction, Scope of Material Management selective control techniques-ABC analysis, Material handling, inventory control, Essential steps in	(06)

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	inventory control, quality standards		
Text/Reference Books			
Sr. No.	**Book**	**Author**	**Publisher**
1	Industrial Engineering and Management	S.C.Sharama	Khanna Publishing House

Pattern of Question paper:

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For 25 Marks Paper:

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA152:Total Quality Management**	**Semester-II**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	Explain basic concepts of total quality management
2.	Apply continuous process improvement techniques
3.	Apply concept of TPM

Unit	Course Content	Hours
Unit 1	Introduction, Basic concepts of total quality management: Introduction to Quality, Dimensions of Quality, Quality Planning, Concept and definition of quality cost, Determinants of Quality, Optimum cost of performance, Principles of TQM, Pillars of TQM, Introduction to leadership and Leadership roles, Quality council and Quality statement, Strategic Planning Process, Deming philosophy	(06)
Unit 2	Continuous process improvement Input /output process Model, Juran trilogy, PDCA Cycle, 5 –'S' Housekeeping principle, Kaizen Seven tools of Quality (Q-7 tools), Check Sheet, Histogram, Cause and effect diagram, Pereto diagram, Stratification analysis, Scatter diagram, Control charts, Control chart for variables & process capability, Control chart for attributes	(06)
Unit 3	Management planning tools & Bench marking Affinity diagram, Relationship diagram, Tree diagram, Matrix diagram, Matrix data analysis, Arrow Diagram, Process decision programme chart (PDPC), Concept of bench marking, Reason to bench marking, Bench marking process, Types of bench marking, Benefits of bench marking	(06)
Unit 4	Just in time (JIT) JIT philosophy, Three elements of JIT, Principles of JIT Manufacturing, JIT Manufacturing building blocks, JIT benefits, Kanban & 2 Bin Systems	(06)
Unit 5	Total productive maintenance (TPM) Concept of Total Productive Maintenance, Types of maintenance, OEE (Overall Equipment Efficiency), Stages in TPM implementation, Pillars of TPM, Difficulties faced in TPM implementation.	(06)

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	Total Quality Management	S.C.Sharma, T.R.Banga	Khanna Publishing Houuse

Pattern of Question paper:.

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For 25 Marks Paper:

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA153:Entrepreneurship**	**Semester-II**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hour

Course Outcomes (CO)

Students will be able to

1.	Explain foundation of entrepreneurship development and its theories.
2.	Identify the type of entrepreneur and the steps involved in an entrepreneurial venture
3.	Apply various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship.

Unit	Course Content	Hours
Unit 1	Entrepreneurship and entrepreneur: Need of Employment and Opportunities, Essential Characteristics of a good Entrepreneur, Industrial Policy, Classification of industries- Micro, small scale , Medium scale, Large scale, Type of industries- Production, Job based & Service	(06)
Unit 2	Entrepreneurial Development: Product identification/ selection, Site selection, Plant layout, Institutional support needed, Pre-market survey	(06)
Unit 3	Entrepreneurship Support System and Start-ups: Introduction to start-up's, Role of District Industries Centre in setting up industry, Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMML, Role of state financecorporation, state electricity corporations, pollution control board, BIS, I.S.O. etc.	(06)
Unit 4	Introduction to Tax System, Insurance and Acts: Idea of income tax, sales tax, excise duty and custom duty, Industrial and fire insurance, procedure for industrial insurance, Introduction to Industrial acts, factory act, Workmen's compensation act 1923, Apprentices act 1961, Environmental protection act 1986	(06)
Unit 5	Project Report Preparation: Procedure of preparing a project report, Format of project report, Preparation of project report, Introduction to ISO: 9000 Series of Quality System	(06)

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	A Textbook of Entrepreneurship Development	K.L.Dangi	ATPA -2014

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Pattern of Question paper:

Question paper shall be based on all 5 units in the syllabus. Question number 1 is compulsory and shall be of objective nature (Multiple Choice Questions, fill in the blanks etc.) and should cover the entire syllabus. Students must solve any THREE questions from remaining five questions based on each unit.

For 25 Marks Paper:

1. Six questions.
2. Question no 1 is compulsory and should cover complete syllabus of the respective course for 10 marks.
3. Remaining five questions will be of 5 marks each.

Any Three questions of 5 marks each from remaining questions are to be solved.

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Maharashtra Institute of Technology, Aurangabad.

(An Autonomous Institute)

B.Voc. (Refrigeration and Airconditioning)

NSQF Level-5	**VRA154:Refrigeration and Airconditioning Applications**	**Semester-II**

Teaching Scheme		Examination Scheme	
Lectures	03 hrs/Week	MSE	10 Marks
Practical	-	TA	15 Marks
Credits	03	ESE	25 Marks
		Duration of ESE	1.5 hours

Course Outcomes (CO)

Students will be able to

1.	Illustrate the fundamental principles and applications of refrigeration and air conditioning system
2.	Summarize varies applications the refrigeration and air conditioning systems.
3.	Discuss the varies applications of refrigeration

Unit	Course Content	Hours
Unit 1	Food Preservation Introduction, factors contributing to food spoilage, causes of food spoilage, methods of food preservation, freezing method of food preservation, preservation of food with direct contact of liquid N2, freeze drying, preservation of different products, cold storage and commercial cabinets.	(06)
Unit 2	Commercial Applications Introduction, air-conditioning of houses, offices, hotels and restaurants, air-conditioning of departmental stores, air-conditioning of theatres and auditoriums, hospitals and medical applications	(06)
Unit 3	Ice-Manufacturing Introduction, principles of ice production, different methods of ice manufacturing, treatment of water for making ice, brines, freezing tanks, ice cans, quality of ice	(06)
Unit 4	Industrial Applications Introduction, importance of RH in different industries, ice-cream manufacturing, refrigeration for breweries, selection of refrigerant for breweries, use of liquid N2 for fabric, quality, air conditioning in textile and photographic industries	(06)
Unit 5	Transport Air Conditioning Introduction, automobile air conditioning, railway air-conditioning, marine air conditioning, aircraft air conditioning	(06)

Text/Reference Books

Sr. No.	Book	Author	Publisher
1	Refrigeration and Airconditioning	Sadhu Singh	Khanna Publishing House
2.	Refrigeration and Airconditioning	C.P.Arrora	McFraw Hill Education (India)(P) Limited, New Delhi
3.	Principles of Refrigeration	Roy J. Dosat	Pearson Education, New Delhi

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4.	Refrigeration and Airconditioning	Manohar Prasad	New Age International (P) limited, New Delhi

Pattern of Question paper:

Question paper shall be based on all 5 units in the syllabus. Question number 1 is compulsory and shall be of objective nature (Multiple Choice Questions, fill in the blanks etc.) and should cover the entire syllabus. Students must solve any THREE questions from remaining five questions based on each unit.

For 25 Marks Paper:

1. Six questions.
2. Question no 1 is compulsory and should cover complete syllabus of the respective course for 10 marks.
3. Remaining five questions will be of 5 marks each.

Any Three questions of 5 marks each from remaining questions are to be solved.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level -5	**VRA171:Basic Electrical Electronics Lab**	**Semester-II**

Teaching Scheme		Examination Scheme	
Practical	Hours/week	TA	25 Marks
Credits	1.5	ESE/PE	25 Marks

Sr.No.	List of Experiments
	Any eight (Four from each Basic Electrical and Electronis)of the following practical should be performed and recorded in laboratory book **Basic Electrical** 1. Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross- sectional area of the conductor. 2. Verification of Ohm's Law. 3. Verification of temperature co-efficient of resistance: (i) Positive for Tungsten and Nichrome and (ii) Negative for carbon. 4. Study of series resistive circuits. 5. Study of parallel resistive circuits. 6. Study of series and parallel connection of cells in circuits. 7. Preparation of Electrolyte for lead acid battery and its charging and **BasicElectronics** 1. Study of current and voltage measurement using Ammeter and Voltmeter. 2. Study of current and voltage measurement using Galvanometer. 3. Study of current, voltage and resistance measurement using of Multi-meter 4. Study of Power and Energy measurement using Wattmeter and Energy meter. 5. Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using Oscilloscope. 6. Study of V-I Characteristic of Diode. 7. Study of V-I Characteristic of Zener Diode. And use of Zener Diode as voltage

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level -5	**VRA172:Refrigeration and Airconditioning Lab.**	**Semester-II**

Teaching Scheme		Examination Scheme	
Practical	Hours/week	TA	25 Marks
Credits	1.5	ESE/PE	25 Marks

Sr.No.	List of Experiments (Minimum 6 experiments)
1	To study varies tools used in refrigeration and Air-conditioning
2	To study working of domestic refrigerator its wiring diagram and maintenance.
3	To study various compressors used in refrigeration
4	To study various controllers in refrigeration (at least ten)
5	To study leak detection and charging of refrigeration system
6	Trial on refrigeration system
7	Trail on ice plan
8	Trial on window air conditioner /air conditioning system/ water cooler

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

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B.Voc. (Refrigeration and Airconditioning)

NSQF Level -5	**On Job Training/Qualification Packs***		**Semester-II**
Teaching Scheme		Examination Scheme	
Practical	7-8 weekS	TA	50 Marks
Credits	15	ESE/PE	150 Marks
VRA181	One more QP to be opted from QPs mentioned in the level 5 first semester		

*Any one On-Job-Training as per guidelines of AICTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC

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