

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

### Third Year B. Voc. Syllabus (Refrigeration and Air Conditioning)

Under Choice Based Credit System (CBCS) Under Faculty of Science and Technology

(Effective from 2022-23 and onwards) Master Copy

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iSQ	F Level -5			Co	ntact Hr	E.		on Saha	hem	PSP
Sr.	Course	Course Title	Credit	pe	r Week	E	valuati	on Sche	me	Hou
No.	Code			L	Р	MSE	TA	ESE	Total	
			Th	eory						
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	3	3	-	10	15	25	50	1.5
-	0	and Emergency Actions	Lab/P	racti	ral					
5.	VRA121	Metrology and Measuring	1.5	-	2		25	25	50	-
6	VP 4122	Heat Transfer Lab	1.5		2		25	25	50	-
0.	TRAILE	On Joh Trai	ning (O.I		alificatio	n Packs			-	
		Field Technician-AC	E COS							
7.	VRAI31 VRAI32	(ELE/Q3102) Field Technician- Refrigeration (ELE/Q3103)	15		7-8 wceks		50	150	200	-
	VRA133	Field Engineer-RACW (ELE/Q3105)	]							
		Total	30	12	4+	40	160	300	500	
•Any	one On-Job-Tr	raining as per guidelines of AICTE	& SSC for t	he giv	en skill sets	for 150 M	arks Exte	rmal Asse	ssment by N	SDC/SS
NSQ	F Level -5			0					Seme	ster -I.
Sr.	Course	Course Title	Credit	Cor	Week	E	Evaluation Scheme			
No.	Code	Course The	Creun	L Per	P	MSE	TA	ESE	Total	Hou
-			Th	cory		12				
1	VRA151	Industrial Management	3	3	-	10	15	25	50	1.5
2.	VRA152	Total Quality	3	3		10	15	25	50	1.5
2	1/0 4 167	Fataosanauschip	3	3		10	15	25	50	1.5
4.	VRAI55	Refrigeration & Air	3	3	-	10	15	25	50	1.5
		Conditioning Applications	Tab/D			and the second	-	-		
	-	Deale Electrical and	Lab/P	racu			-	10-1		
5.	VRA171	Electronics Lab	1.5	•	2	·*	25	25	50	
6.	VRAI72	Refrigeration and Air- conditioning Lab	1.5	•	2	<b>-</b>	25	25	50	8 <b>-</b> -
	S-SALE-STERNE	On Job Train	ning (OJ)	ſ)/Qı	alificatio	n 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	-
	1	Total	30	12	4+	40	160	300	500	
Any	one On-Job-Tr	ainings per guidelines of AICTE	& SSC for I	he giv	en skill sets	for 150 M	arks Exte	emal Asse	ssment by N	SDC/SS
	1-			(2)	nat				Page 2,0	,18
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		Curriculum for B. Voc	Refriger	ratio	and Ai	r Condi	tioning	Mas	ter C	vgo
NSQ	F Level -6								Sein	1- 13469
Sr.	Course	Course Title	Credit	Contact Hr per Week		Evaluation Scheme				ESE
	Code			L	P	MSE	TA	ESE	Total	Hour
			Th	eery						
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	VR.A204	RAC Standards	3	3		10	15	25	50	1.5
			Lab/P	ractio	al					
5.	VRA221	RAC Material Lab	1.5	-	2	-	25	25	50	-
6.	VR.4.222	RAC Systems Installation and its Maintenance Lab-1	1.5	-	2	-	25	25	50	-
		On Job Trai	ning (OJ	T)Qu	alificatio	a Packs				
	VRA231	Satiny Team -RACWO (ELE Q3605)								
7.	VRA232	Field Engineer-RACW (ELE Q3105)	15	-	7-8 weeks	-	50	150	200	-
	VRA233	Cold Storage Technician FIC Q7004)								
-		Total	30	12	4+	40	160	300	500	- Col

"Any one On-Job-Training is per gradelines of AJCTE & SSC for the given skill sets for 150 Marks External Assessment by NSDC/SSC

Sr.	Course	se Course Title	Credit	Con	rtact Hr r Week	E	valuati	on Sche	me	ESE
NO.	Code			Ĺ	P	MSE	TA	ESE	Total	Hour
		and the second second	Th	eery						
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 -1	3	3	-	10	15	25	50	1.5
			Lab/P	ractio	cal					
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	-
	7.	On Job Trai	ning (OJ	DQ.	alificatio	e Packs	•		3	-
7.	VRA281	One more QP to be opted from QPs mentioned in the level 6 first sem	15	-	7-8 weeks		50	150	200	
	The second	Total	30	12	4+	40	160	300	500	
Azy	one Qu-Job-Tr	raning as per guidelines of AJCTE	& SSC for 1	× 6	en skill sen	s far 150 M	larks Exa	email Asse	Page By	SDC 55



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Curriculum for B. Voc Refrigeration and Air Condition ing

NSQ	F Level -7								Sem	ester -I
Sr.	Course	Course Title	Credit	Con	tact Hr Week	E	valuati	on Scher	ne	ESE
NO.	Code	Code		L	Р	MSE	TA	ESE	Total	Hour
			Th	eory						
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 Air- Conditioning	3	3	-	10	15	25	50	1.5
4.	VRA304	Non-conventional Refrigerating System	3	3	-	10	15	25	50	1.5
			Lab/P	ractio	cal					
5.	VRA321	Automobile AC Lab	1.5	-	2	-	25	25	50	- 3-
6.	VRA322	AC components and Assembly Laboratory	1.5		2	1	25	25	50	°-
		On Job Trai	ning (OJ	T)/Qu	alificatio	n Packs'				
7.	VRA331	AC Specialist- Automobile (ASC/Q1416)	15		7-8		50	150	200	-
	VRA332	Assembly Operator (ELE/Q3501)			weeks					
		Total	30	12	4+	40	160	300	500	-
*An Asso	y one On-Jol essment by N	o-Training as per guidelines	of AICTE	& SS	SC for the	given sl	cill sets	for 150	Marks Ex	ternal

NSQ	F Level -7								Seme	ster -I
Sr.	Course	Course Title	Credit	Cor	ntact Hr r Week	E	ne	ESE		
NO.	Code			L	Р	MSE	TA	ESE	Total	Hou
			Th	eory						
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
		and the second s	Lab/P	racti	cal				-	
3.	VRA371	Project	9	-	4		100	100	200	-
		On Job Trai	ning (OJ'	T)/Q1	alificatio	n 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	
		Total	30	6	4+	20	180	300	500	1.
Any	y one On-Jol ssment by N	b-Training as per guidelines (SDC/SSC	of AICTE	& S	SC for the	given sl	kill sets	for 150	Marks E	ternal
	1-	-6		-						
	)	· ·		(Ba						
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## Semester-V (NSQF Level 7, Semester-I) Detail Course Curriculum

## Third Year B. Voc. Syllabus (Refrigeration and Air Conditioning)

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NSQF Level-7 VRA301: RAC Maintenance-II Semester-I							ester-I		
Т	eaching S	Scheme			Exa	mination	Schem	ie	
Lectures		03 hrs/Week	]		MSE		10 Ma	rks	
Practical		-	]		TA		15 Ma	rks	
Credits		03	]		ESE		25 Ma	rks	
					Duration o	f ESE	1.5 ho	urs	
Course	Outcom	es (CO)							
Students	will be a	able to							
1.	Master	diagnosis, servi	cing, and	maintenance of ref	frigeration sy	stems.			
2.	Apply e	ffective technic	ques for se	ervicing and repair	ing refrigera	tion syste	ems.		
3.	Trouble	shoot and resol	ve electri	cal and mechanical	faults in ref	rigeration	n systen	ns.	
Unit			C	ourse Content				Hours	
Unit 1	Introduction: Checking the charge, electrical circuits (servicing), (02)								
	evacuation of the system, installation, and location of main components,								
	leak detection methods								
Unit 2	Servicing Techniques: Piping and Joining Work, Burn out repair, capillary (08)								
	tube cle	aning				61		(00)	
Unit 3	Chargi	ng the system	a: compre	essor work expan	sion valve	(thermos	tatic),	(09)	
	servicin	ig, hermetic co	ompressor	motors (stating ]	problems) re	epairing	leaks,		
TI-IA A	sealed s	system connecti	dings.	manage motor	faile to star	4		(00)	
Unit 4	motors	tries to start b	ung; Co	of Fun compressor	motor start	s but do	es not	(09)	
	reach n	unning sneed t	hermostat	failure type nress	sure cut-out	failure y	viring		
	and coll	lection faults	iler mostat	initiate type, press	Sure curour	landie,	aning		
Unit 5	Mecha	nical Fault	Finding	Fault analysis	s by tem	nerature	and	(08)	
Onic 5	nressure	e methods	of confi	rming the fault. f	inding the	fault whe	en the	(00)	
	compre	ssor is not runn	ing, abnor	mal noise					
	problem	, domestic syst	tem faults						
Text/Re	ference	Books							
Sr. No.		Book		Author	r	I	ublish	er	
	A co	ourse in Refrig	geration	S.C. Arora	and S.	Dhang	atrai ar	d sons,	
1.	and Air Conditioning Domkundwar Delhi								
2	Re	frigeration and	l Air	Manahar D	mend	New a	ge Inter	mational	
2.		Conditioning	3	Ivianonar P	lasad	(P) Lim	ited, N	ew Delhi	
	El	ectric controls	for			M	cGraw-	hill	
3.	Re	frigeration and	d Air	Shan K W	/ang,	Intern	ational	Edition.	
		Conditioning	3			5	Singapo	re	

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NSQF Lo	evel-7	VRA3	02: RAC Installation Techniques-II	Sem	ester-1
Te	aching	Scheme	Examination	Scher	1147
Lectures		03 hrs/Week	MSE	10 M	arks
Practical		-	TA	15 M	arks
Credits		03	ESE	25 M	arks
			Duration of ESE	1.5 h	ours
Course O	utcome	es (CO)			
Students v	vill be a	ble to			
1.	Maste	r air conditioning	installation, operation, and testing techniques.		
2.	Execu	te evacuation and	d dehydration procedures effectively		
3.	Demo	nstrate proficien	cy in installing room and split air conditioner	s with	proper
	ventil	ation.			
Unit			Course Content		Hours
Unit 1	Intro	duction:			(02)
	Instal	lation operation, a	adding oil, testing for leak detection		
Unit 2	Evace	uation and dehy	dration:		(09)
	Remo	ving air, chargi	ng of the system, through suction valve, the	rough	
	discha	arge valve.			
Unit 3	Instal	lation of Room	Air-Conditioner:		(08)
	Select	tion of proper lo	cation, providing proper slope and provision t	for to	
	drain	water			
Unit 4	Venti	lation:			(09)
	Arran	gement for wind	ow air conditioner, wiring diagram for installation	on for	
	room	air, conditioner			
Unit 5	Instal	lation of split a	ir conditioner, providing arrangement for pipe	s and	(08)
1	pipe,	pipe insulations			

Text/Refe	rence Books		
Sr. No.	Book	Author	Publisher
L.	A course in Refrigeration and Air Conditioning	S.C. Arora and S. Domkundwar	Dhanpatrai and sons. Delhi
2.	Refrigeration and Air Conditioning	Manohar Prasad	New age International (P) Limited, New Delhi
3.	Electric controls for Refrigeration and Air Conditioning	Shan K Wang,	McGraw-hill International Edition, Singapore

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Syllabus Optimited Voluce Institute) Syllabus Optimited Voluce Institute (An Autonomous Institute)

NSQF I	.evel-7 VR	A303: Automob	ile Air Conditioning	Semes	ter-I
Те	aching Scheme		Exami	nation Scheme	
Lectures	03 hrs/Week		MSE	10 Marks	
Practical			TA	15 Marks	
Credits	03		ESE	25 Marks	
			Duration of ESE	1.5 hours	
Course C	outcomes (CO)				
1	Acquire mastery in	refrigeration m	athods designing AC	" systems and net	forming
•••	maintenance services	renigeration in	culous, designing Av	systems, and per	torning
2	Demonstrate profic	ency in design	ing automobile AC	systems and cou	ntrolling
2.,	temperature effective	lv.	ing automobile Ac	systems and con	ntoninį
3	Develop expertise in	servicing and co	ontrolling AC system	s, including diagnos	stics and
2.	troubleshooting.	servicing and e	shironing rice system.	s, menualing and gives	
Unit	dedeneering.	Course	Content		Hours
Unit 1	Introduction: Meth	ods of refrigerati	on. Vapour compres	sion refrigeration	(08)
	system, vapour abs	orption refrig	eration system,	applications of	(
	refrigeration &	air conditio	ning, Automobile air	conditioning, air	
	conditioning for r	assengers, isola	ted vehicles, Refri	gerated transport	
	vehicles, applicatio	ns related with	very low temper	atures, Study of	
	Psychometric charts	Psychometric	properties, tables/cha	rts, psychometric	
	processes, comfort	charts, factors a	ffecting comfort, effe	ctive temperature,	
	ventilation requireme	ents			
Unit 2	Refrigerants & A	C Systems: Imp	ortance of Refrigera	nt- Classification,	(07)
	properties, selection	criteria, comm	nonly used refrige	rants, alternative	
	refrigerants, eco-fr	iendly refriger	ants; applications	of refrigerants,	
	refrigerants used	in automobile	air conditioning,	Air Conditioning	
	Systems- Classific	ation, layouts,	central / unitary	air conditioning	
	systems, System con	ponents, Switch	and electrical wiring	circuit.	
Unit 3	Design Automobil	e AC system	Load Calculation	ns & Analysis-	(07)
	Design consideration	ons for achievin	ng desired inside/room	m conditions with	
	respect to pr	evailing out	side/environment	conditions.Factors	
	affecting/contributin	g towards the	load on refrigeration	on & air	
	conditioning system	ems, Cooling	& heating lo	ad calculations,	
	Load calculations	for automob	iles, Effect of air con	nditioning load on	
	engine				
Unit 4	Air Distribution:	Air Distribution	Systems- Distributio	on ducting, sizing,	(07)
	supply / return du	cts, type of g	rills, diffusers, vent	ilation, air noise	23 - 45
	level, layout of du	ct systems for a	utomobiles and thei	r impact on load	
	calculations, Air	Routing & Ter	mperature Control	-Objectives of the	
1	dashboard re-circul	ating unit, autor	matic temperature co	ontrol, controlling	
1-	flow, control of air h	andling systems	& air flow through - e	vaporator care	
hairman	Board of Studies			P	age 8 of
yllabuood	Idrisd 2000 Bioyoc. (Refri	geration and Air C	onditioning) (2022-23	Autonomous Pattern)	
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Unit 5	AC Service & Control: Air Con maintenance & service - remov Compressor service, Testing, Dia conditioning system, Refrigerant gas heater system, Air Conditioning as thermostats, humidistat, control dat	Aditioning Service- Air ving & replacing C gnosis & trouble shoot charging procedure &. S Control - Common cor mpers, pressure cut outs, re	conditioner (07) components. ing of air Servicing of ntrols such lays.			
Referen	ce Book					
Sr. No.	Book	Author	Publisher			
1.	A course in Refrigeration and Air Conditioning Domkundwar sons, Delhi					
2.	Hand book of Air conditioning and refrigeration	Shan K Wang	McGraw-hill International Edition. Singapore			

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NSQF Le	evel-7 VRA304:Non-conv	entional Refrigerating Sy	stem Se	mester-I					
Tea	aching Scheme		Examination Sch	eme					
Lectures	03 hrs/Week	MSE	10	Marks					
Practical		TA	15	Marks					
Credits	03	ESE	25	Marks					
		Durat	ion of ESE 1.5	hours					
Course (	Dutcomes (CO) -								
Students	will be able to								
1.	Master absorption refrigeration pr	inciples and analyze design	effectively.						
2.	Explore alternative refrigeration to	echnologies through analys	is of absorption s	ystems.					
3.	Understand steam jet refrigeration	on systems and thermo-el	ectric effects for	potential					
Unit	Co	urse Content		Hours					
Unit 1	Vapour Absorption Refriger	ation System:		(07)					
	Principle of absorption system, comparison between vapour								
	compression system and va	oor absorption system,	theory of binar	y					
	mixtures,								
Unit 2	Jnit 2 Aqua-ammonia vapour absorption system, theory of mixtures, (08)								
	temperature concentration diagra	m and enthalpy conce	ntration diagram	1.					
	processes used in								
	Aqua-ammonia absorption syste	m, adiabatic mixing, sep	aration, throttlin	g					
	process.								
Unit 3	Vapour absorption system i	is components, working	principle an	d (07)					
	mathematical analysis, Lithium-	bromide- water absorp	ion system it	s					
I luit 4	components, working principle, a	nd mathematical analysis		(07)					
Unit 4	Introduction steam int refrige	i ration sustam componen	in of staam is	. (07)					
	refrigeration system advantage	and limitation of steam	iat refrigamtio						
	system performance of steam jet	refrigeration system	jet temgetano	"					
Unit 5	Thermo-Electric Refrigeration	System:		(07)					
Canto	Introduction, thermo-electric effe	ects. Seebeck effect. Peltie	r effect. Thomso	n (0/)					
	effect								
Referen	ce Book								
Sr. No.	Book	Author	Publis	ner					
1	A course in Refrigeration and	S.C. Arora and S.	Dhanpatrai a	ind sons,					
1	Air Conditioning	Domkundwar	Delh	i					
2	Refrigeration and Air	Manahar Presed	New age Inte	ernational					
2.	Conditioning	Wanonar Prasad	(P) Limited, N	New Delhi					
	Handbook of Air Conditioning		McGraw	/-hill					
3.	and Refrigeration	Shan K Wang	International	Edition,					
	and Kenigeration		Singap	ore					
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NSQF I	.evel-7		VRA321: Automobile AC Lab		Semester-I				
	leaching S	Scheme		Examin	ation Scheme				
Practical		2 Hours/week		TA	25 Marks				
Credits		1.5		ESE/PE	25 Marks				
Sr. No.			List of Experiments						
	Any six	of the followin	g practical should be performe	d and recorded	in laboratory				
	book								
	1. To study the load requirement of AC in the vehicle.								
	2. To design the AC System for the automobile according to the use.								
	3. To select the components for Automobile AC System								
	4. To in	4. To install the AC System in automobile							
	5. Tod	5. To diagnose the fault in Automobile AC System							
	6. To c	onduct the mech	anical repair in the Automobile A	AC System					
	7. To c	harge the Refrig	erant in the Automobile AC Syst	em					
	8. Tota	est the Automob	ile AC System.						

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-7		VRA322: A0	Components and Assembly Labor	atory	Semester-I
Teaching Scheme		Scheme		Examin	ation Scheme
Practical		2 Hours/week		TA	25 Marks
Credits		1.5		ESE/PE	25 Marks
Sr. No.			List of Experiments		
	Any fiv	e of the following	ng practical should be performed an	d recorded	d in laboratory
	book				
	1.	To study herme	tically sealed compressor, condens	ing units,	performance,
	volumetric efficiency, performance of the ideal compressor and powe requirement				or and power
	2.	To study differen	t types of condensers and condenser d	esign	
	<ol> <li>To study different types of evaporators and evaporator performa drop in tubes, frost.</li> </ol>			nance, pressure	
	<ol><li>To study selection of expansion valves, and capillaries for refrigeration and air conditioning applications</li></ol>			s for various	
	5.	Find out the hea and effect of foul	t rejection factor of condenser, conde ing factor	enser capa	city, efficiency
	6.	Capillary bore cl capillary tube and	ecking, performance test conducted d thermostatic expansion valve) for fir	by test rig ding C.O.	(consisting of P.
	Familia	arization of capilla	ary selection guide		

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 Lev	el -7 On Job Train	ning/Qualification Packs*	Semester-I		
Teac	hing Scheme	Examinatio	on Scheme		
Practical	7-8 weeks	TA	50 Marks		
Credits	15	ESE/PE	150 Marks		
VRA331	AC Specialist – Automobile (ASC/Q 1416)				
VRA332	Accomble Operator (ELE/02501)				
	Assembly Operator (EEE/	Q5501)			
*Any one C Marks Exte	In-Job-Training as per guideling rnal Assessment by NSDC/SSC	es of AICTE & SSC for the give	en skill sets for 150		

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## Semester-VI (NSQF Level 7, Semester-II) Detail Course Curriculum

## Third Year B. Voc. Syllabus (Refrigeration and Air Conditioning)

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#### Syllabus for Third Year B. Voc. (Refrigeration and Air Conditioning)

NSQF Level-7		VRA351:RAC Safety Semes			Semest	ter-II
Leaching		Scheme		Examination	Scheme	
Lectures		03 hrs/Week		MSE	10 Marl	ks
Practical	tical - TA		TA	15 Mar	ks	
Credits		03		ESE	25 Mar	ks
				Duration of ESE	1.5 hou	rs
Course (	)utcom	es (CO)				
Students	will be	able to				
1.	Master	industrial safet	principles and accident pro	evention techniques		
2.	Implen	nent safety meas	ures specific to RAC engine	eering.		
3.	Identif	y and mitigate p	otential hazards in RAC eng	gineering.		
Unit			Course Content		1	lours
Unit 1	Introd	uction to Ind	ustrial Safety: History a	ind development of	safety	(08)
	moven	nent, need for	safety, safety legislation	n: acts and rules, s	safety	
	standar	rds and codes,	safety policy: safety			
	organiz	ation and re	sponsibilities and author	rities of different l	evels,	
	accide	nt sequence the	ory, causes of accidents,	, accident prevention	and	
	control techniques, plant safety inspections, job safety analysis and					
	investi	gation of accide	nts, first aid.			
Unit 2	Overv	iew of Stands	rd: ANSI/ASHRAE Star	ndard, ANSI/ASME	boiler	(07)
	and pressure vessel code, refrigeration, piping code, boiler and pressure					
	vessel code, safety for refrigerant- containing components and accessories,					
	nonelectrical, uniform mechanical code, basic national mechanical code					
Unit 3	Safety	for RAC Engin	eers:			(07)
	Safety	on the Job: Per	onal safety, protective clot	hing and equipment, ha	Irmful	
	substar	nces, safe wor	k, practices, safety when	working with elect	ricity,	
	refrige	ration safety.				
Unit 4	Safety for RAC Engineers: Types of accident, physical injuries from (					(07)
	mechanical causes, use of tools and handling precautions, electrical injuries,					
	electric	cal safety rules				
Unit 5	Injurio	es in RAC an	d Precaution: Refrigeran	at cylinder, corrosion,	burn	(07)
	and other scalds, refrigerants and other gases Construction materials, fire			s, fire		
	fighting precautions, breathing, toxic gases, asphyxiation and precaution for					
	the san	ne.				

Reference	Book		
Sr. No.	Book	Author	Publisher
1	Air Conditioning Systems Principles, Equipment and Services	Joseph Moravek	Prentice Hall
2.	HVAC Handbook, Part I and II,		ISHRAE
3.	Industrial Refrigeration Hand Book	Wilbert F. Stoecker	

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#### Syllabus for Third Year B. Voc. (Refrigeration and Air Conditioning)

NSQF Le	evel-7 VRA352	: Process Planni	ng and Cos	t Estimation	Semes	ter-II	
Te	aching Scheme			Examination	1 Scheme		
Lectures	03 hrs/Week			MSE	10 Mar	ks	
Practical				TA	15 Mar	ks	
Credits 03				ESE	25 Marks		
	Duration of ESE 1.5 ho				1.5 hou	rs	
Course C	Jutcomes (CO)						
Students	will be able to						
1.	Master process planning	ng and cost estim	ation for RA	C systems.		_	
2.	Develop skills in adva	nced cost estimat	tion techniqu	ues.			
3.	Calculate assembly an	d installation tim	e for RAC s	ystems			
Unit		Course	Content	•		Hours	
Unit 1	Introduction to Proce	ess Planning:				(07)	
	Process Planning De	finition, Purpos	se & Conce	pt of Process Pl	anning,	, 이야지, 이야지, 이야지, 이야지, 이야지, 이야지, 이야지, 이야지	
	Objectives & Scope of	f Process Plannin	g, and Opera	ation Planning Sheet	t		
Unit 2	<b>Process Planning act</b>	ivities:				(07)	
	Process Planning Pro	ocedure & Appr	oaches &	Manual Process Pl	anning,		
	Computer Aided Pro	ocess Planning,	Factors Af	fecting Selection I	Process,		
	Machine Capacity	, Determination	of Man,	Machine and M	Material		
	Requirements, Factors	Influencing Cho	ice of Mach	inery			
Unit 3	Introduction to Cost	Estimation:				(07)	
	Reasons for doing	Estimates, Im	portance & o	objectives of Esti	mating,		
	Functions of Estimat	ing, Importance	of Costing	, Aims of Cost Acco	ounting,		
	Difference Between Cost Estimating and Accounting, Cost of Product						
	(Ladder of Cost)	Estimation of	Production	Cost & Material	Cost,		
	Mensuration						
Unit 4	Advanced Cost Estimation Techniques: (07					(07)	
	In advanced cost estin	mation, the focus	s shifts towa	irds precise producti	ion cost		
	estimation, incorporat	ing mensuration	techniques t	o accurately assess i	material		
	requirements. Unders	tanding the impo	ortance of co	osting and the aims	of cost		
	accounting becomes paramount to ensure efficient cost estimation practices.						
Unit 5	Assembly & Installation Time Calculation: (0					(08)	
	Calculating assembly	and installation	time, require	ements for the Refri	geration		
	and Air Conditioning	(RAC) system. I	Jesign and s	election of compone	ents and		
	materials. Steps involve the fabrication, installation, and rigorous testing of						
DC	the RAC system to en	sure its functiona	anty and effi	ciency.			
Reference Book							
Sr. N0.	Book Author Publis				isher		
1	Frocess Planning	g and Cost	B. Ve	enkatachalam	PHILE	arning	
	Heating Ventilat	ing and Air	Fave C N	AcQuiston Jamld	PVI. LID		
2.	Conditioning: Analysis and Design D. Parker, Jeffrey D. Spitler Wiley				India		
	1 D. Parker, Jettrey D. Spitter						

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Chairman Board of Studies Syllabus of Thigh Paulano Refrigeration and Air Conditioning) (2022-23 Autonomous Pattern)

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NSQF Level-7		VRA371:Project		Semester-II
Teach	ing Scheme	E	xamina	ation Scheme
Practical	4 Hours/wk	ТА		100 Marks
Credits	9	ES	E/PE	100 Marks
Course Out	comes (CO)			

#### Students will be able to

- Execute a vocational project demonstrating proficiency in skills learned from B.Voc. Level 5 to Level 7.
- Apply theoretical knowledge to practical scenarios, enhancing vocational competencies

3. Demonstrate mastery in vocational skills through project completion and implementation. On the basis of learning in the B. Voc. Programme, i.e. Level 5 to Level 7, a project to be

taken up by the student strengthening his/ her vocational skills and prepare a report in following format:

#### Formatting:

• The font for chapter number should be in Calibri 16 and chapter title should be in upper case with Bold Calibri 20. Use after paragraph spacing should be 6 pts.

• The font for sub-title like (1.1) should be in Bold Calibri 14 and chapter title should be in upper case with Calibri 20. Use text font as Calibri 12 for a text with 1.5 line spacing. The text should be aligned with justify setting.

#### Report:

• Student has to submit a detailed report in two copies which shall be used for evaluation.

#### **Evaluation:**

Teachers Assessment will be based on the presentation of project in periodic reviews (like Review 1 and Review 2) during the semester.

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NSQF Lev	vel -7 VRA381	VRA381:On Job Training/Qualification Packs* Semester		
Teac	hing Scheme	Examination	Scheme	
Practical	7-8 weeks	ТА	50 Marks	
Credits	15	ESE/PE	150 Marks	
VRA381	One more QP to be opted from QPs mentioned in the level 7 first semester			
*Any one ( Marks Exte	On-Job-Training as per ernal Assessment by N	guidelines of AICTE & SSC for the given DC/SSC	skill sets for 150	

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