STATE BOARD OF TECHNICAL EDUCATION, KERALA									
TEACHING AND EXAMINATION SCHEME FOR KGCE PROGRAMME									
PROGRAMME NAME : KGCE IN REFRIGERATION & AIR CONDITIONING						PROGRAMME CODE :			
DURATION OF PROGRAMME : 2 YEARS									
YEAR : First Year						SCHEME : Revision 2022			
Sl.No	Course Code	Course Name	Teaching Scheme				Evaluation Scheme		
			Contact Hours/ Week			Total hours in the year	Continuous Assessment	End of Year Assessment	Total Marks
			L	P	Total				
1	1001	Basic Mathematics and Science	4	0	4	160	40	60	100
2	1002	Engineering Drawing	2	0	2	80	40	60	100
3	1071	Refrigeration (Trade Theory)	6	0	6	240	40	60	100
4	1079	Refrigeration & Air Conditioning Practical-I (Trade Practical)	0	24	24	960	150	250	400
			12	**24**	**36**	**1440**			**700**

On the Job Training conducted after first year						
	1009	On the Job Training (OJT) - I	4 weeks			

YEAR : Second Year						SCHEME : Revision 2022			
Sl.No	Course Code	Course Name	Teaching Scheme				Evaluation Scheme		
			Contact Hours/ Week			Total hours in the year	Continuous Assessment	End of Year Assessment	Total Marks
			L	P	Total				
1	2001	Employability Skills & Enterpreneurship	1	2	3	120	40	60	100
2	2071	Refrigeration & Air Conditioning (Trade Theory)	5	0	5	200	40	60	100
3	2079	Refrigeration & Air Conditioning Practical-II (Trade Practical)	0	24	24	960	150	250	400
4	2008	Project Work	0	4	4	160	50	50	100
			6	**30**	**36**	**1440**			**700**

On the Job Training conducted after second year						
	2009	On the Job Training (OJT) - II	4 weeks			

Teaching Scheme : L - Lecture, P - Practical

KGCE IN REFRIGERATION AND AIR CONDITIONING - MODEL CURRICULUM							
Programme Title : KGCE in Refrigeration and Air Conditioning						**Notional Hours: 2880**	
COURSE NAME & CODE	**TOPIC / MODULE**	**THEORY (Hrs)**	**PRACTICAL (Hrs)**	**OBJECTIVE OF MODULE**	**OUTCOME OF MODULE**	**METHEDOLOGY**	**TOOLS REQUIRED**
YEAR 1							
Basic Mathematics & Science **(1001)**	**Module M1** Basic Mathematics calculations & Algebra	40	0	OB 1.1 To understand principles of basic mathematics and calculation including Fraction, Ratio & Proportions, Basic Algebra	**Will be able to:** MO-1.1 Perform basic mathematical calculations in Fraction, Ratio & Proportions, Basic Algebra	- Lecture - Use of smart class rooms - Use of instructional guidelines	- Laptop & Projector - Guideline documents
	Module M2 Mensuration and Trigonometry	40	0	OB 2.1 To understand principles of Mensuration and Trigonometry	MO-2.1 Perform basic mathematical calculations and solve sample probles related to Mensuration and Trigonometry	- Lecture - Use of smart class rooms - Use of instructional guidelines	- Laptop & Projector - Guideline documents
	Module M3 Basic Science	40	0	OB 3.1 To understand principles of basic Science including System of units, Unit Conversion Mass/weight/volume/density, Work/power/energy, Velocity/Speed, elasticity	MO-3.1 Understand the concepts of basic science including : System of units, Unit Conversion MO-3.2 Define - Mass/weight/volume/density, Work/power/energy, Velocity/Speed, elasticity	- Lecture - Use of smart class rooms - Use of instructional guidelines	- Laptop & Projector - Guideline documents
	Module M4 Basic Science	40	0	OB 4.1 To understand principles of basic Science including Heat, Pressure & Temperature and thier applications. OB 4.2 To Understand the concepts of Basic electricity - AC/DC/Voltage, Current , Resistance, Ohms law	MO-4.1 Define - Heat, Pressure & Temperature and their applications MO-4.2 Explain - AC/DC/Voltage, Current , Resistance, Ohms law	- Lecture - Use of smart class rooms - Use of instructional guidelines	- Laptop & Projector - Guideline documents
	Module M1	8	0	OB 1.1 To understand different instruments used in engineering drawing	MO-1.1 List various instruments used in engineering drawing MO-1.2 State uses of various drawing instruments MO-1.3 Use various instruments to draw sample exercises	- Lecture - Demonstration	

Engineering Drawing **(1002)**	Introduction to Engineering Drawing Practice	10	0	OB 1.2 To understand freehand sketching, lettering and dimensioning	MO-1.4 Understand the application of freehand sketching, lettering and dimensioning, Layouting and title block MO-1.5 List various dimensioning methods MO-1.6 Solve problems based on different dimensioning methods	- Lecture - Demonstration	- Scales, Compass, Drawing board, Clips, Mini drafter, Pencils, Drawing sheets, Stencils, Instrument box - Laptop & Projector
	Module M2 Geometrical Drawing	20	0	OB 2.1 To understand Geometric constructions and drawings of various objects and shapes	MO-2.1 Draw lines, angles, triangles, squares, polygons, threads, fasteners based on sample exercises	- Lecture - Demonstration	
	Module M3 Orthographic Projection	20	0	OB 3.1 To draw orthographic projections of various objects	MO-3.1 State the concept of quadrants in engineering drawing MO-3.2 Differentiate first angle and third angle projection MO-3.3 Prepare orthographic projection of given sample objects	- Lecture - Demonstration	
	Module M4 Shop floor drawing	22	0	OB 4.1 To undestrand and draw shop floor drawings	MO-4.1 State the importance of shop floor drawing in industry MO-4.2 Prepare isometric drawings of given sample objects MO-4.3 Prepare assembly drawing of given sample products	- Lecture	
REFRIGERATION THEORY (1071)							
		2		M 1.1 Understand the basic safety measures, workshop operations in sheet metal, fitting and metal joinig processes.	Identify trade related hazards and safety procedures following safety precautions.		
		6			Explain the methods to produce fitting jobs as per drawing (Range of operations: marking, sawing, filing, drilling, reaming, tapping and dieing etc.).		
		6			Explain the methods produce Sheet metal components (range of operation – marking, metal cutting, bending, riveting and soldering etc.).		

REFRIGERATION THEORY	**M 1. Safety rules, basic workshop practice, RAC system**	6		M 1.2 Understand the basic concepts in electrical and electronics components.	Identify electrical safety. Join different wire, measure power, currents, volts and earth resistance etc. Connect single phase, 3 phase motors i.e. star and delta connections.			
		10		M 1.3 Appreciate the components and tools for the maintanance of RAC system	Identify the electronic components and their colour code i.e. transistor, capacitor, diode, amplifier, I.C and able to work soldering.			
		9			Illustrate gas welding, brazing, soldering observing related safety.			
		15			Identify RAC tools and equipment and recognise different parts of RAC system. Perform copper tube cutting, flaring, swaging, brazing.			
REFRIGERATION THEORY	**M 2.Mechanical and electrical components of RAC system, Compressor and its working**	9		M 2. 1 Comprehend mechanical and electrical components of RAC system	Explain mechanical & electrical components. Perform leak test, vacuuming, gas charging, wiring & installation of refrigerator.			
		6			Identify electrical and mechanical components of a refrigerator.			
		12			Explain compressor motor terminal, start compressor Direct with relay & without relay, technique of flushing, leak testing, replacing capillary & filter drier, evacuation & gas charging.			
		9		M 2. 2 Understand the details of compressor in RAC system	Illustrate components of frost-free refrigerator (electrical / mechanical), wiring of frost-free freeze & air distribution in refrigerator sector. Leak detection, evacuators & gas charging.			
		9			Explain the procedure to dismantle, repair and assemble hermetic, fixed and variable speed compressor, and test performance.			
		8			Identify the terminals of sealed compressor and their wiring and measure current, volts, watts and use of DOL starter with different types of motors.			
		4			Describe the selection of Hermetic compressor for different appliances, starting methods, testing controls & safety cut out used in sealed compressor.			
		5			Explain servicing & de-scaling of condenser (internals &externals) used in different appliances.			
		5			Explain fitting & adjustment of expansion devices, drier, filter & refrigerant controls used in different refrigeration system.			

REFRIGERATION THEORY	**M 3. Components of refrigerator- evaporator, expansion devices and condensor. Refigerants**	5		M 3.1 Understand the working and maintenance of evaporator, condensor and expansion devices	Explain servicing of different evaporator used in different appliances.			
		6		M 3.2 Know various refrigerants and their uses	Describe the procedure to Carry out Recovery and Recycling of Refrigerant used, alternative of CFC, HFC re- cover, transfer & handling of gas cylinders.			
		7			Explain Retrofit CFC/HFC machine with ozone friendly refrigerant with understanding of the compatibility.			
		2			Explain Pack thermal insulation and prevent cooling leakage.			
		7			Explain servicing of evaporator & chillers.			
REFRIGERATION THEORY	**M 4. Installation, Service and maintanance of refigeration system**	18		M 4. 1 Understand service and maintenance of various refrigeration equipments.	Explain the procedure to carry out servicing and retrofit of Water cooler and dispenser.			
		3			Explain service, retrofit of visible cooler and bottle cooler and test performance.			
		3			Describe the procedure to conduct servicing of deep freezer and test performance.			
		9			Draw and apply engineering drawing for different application in the field of work.			
		12			Recall the basic mathematical concept and principles to perform practical operations. Describe and explain basic science in the field of study.			
		18			State the procedure to carry out servicing, dismantling, checking different parts of different types of commercial compressor, re-placing worn out parts, Check lubrication system. Assemble & check performance.			
		12			Explain servicing of different types of water- cooled condenser.			
		6			Explain servicing and performance test of Cooling tower.			
		6			Discuss the procedure for Servicing, backwash & re-generate Water treatment plant of circulating water.			
		5			Show fitting of expansion valve, adjustment of refrigerant flow according to heat load.			
REFRIGERATION & AIR CONDITIONING PRACTICAL-1 (1079)								
			15		Identify trade related hazards and safety procedures following safety precautions.			

REFRIGERATION & AIR CONDITIONING PRACTICAL-1	**M 1. Safety rules, basic workshop practice, RAC system**		25	M 1.1 Understand the basic safety measures, workshop operations in sheet metal, fitting and metal joinig processes.	Produce fitting jobs as per drawing (Range of operations: marking, sawing, filing, drilling, reaming, tapping and dieing etc.).		
			25		Produce Sheet metal components (range of operation – marking, metal cutting, bending, riveting and soldering etc.).		
			30		Identify electrical safety. Join different wire, measure power, currents, volts and earth resistance etc. Connect single phase, 3 phase motors i.e. star and delta connections.		
			20	M 1.2 Understand the basic concepts in electrical and electronics components.	Identify the electronic components and their colour code i.e. transistor, capacitor, diode, amplifier, I.C and able to work soldering.		
			30	M 1.3 Appreciate the components and tools for the maintanance of RAC system	Perform gas welding, brazing, soldering observing related safety.		
			75		Identify RAC tools and equipment and recognise different parts of RAC system. Perform copper tube cutting, flaring, swaging, brazing.		
REFRIGERATION & AIR CONDITIONING PRACTICAL-1	**M 2. Mechanical and electrical components of RAC system, Compressor and its working**		40	M 2. 1 Comprehend mechanical and electrical components of RAC system	Test mechanical & electrical components. Perform leak test, vacuuming, gas charging, wiring & installation of refrigerator.		
			25		Identify electrical and mechanical components of a refrigerator.		
			30		Test compressor motor terminal, start compressor Direct with relay & without relay, technique of flushing, leak testing, replacing capillary & filter drier, evacuation & gas charging.		
			40	M 2. 2 Understand the details of compressor in RAC system	Check components of frost-free refrigerator (electrical / mechanical), wiring of frost-free freeze & air distribution in refrigerator sector. Leak detection, evacuators & gas charging.		
			30		Dismantle, repair and assemble hermetic, fixed and variable speed compressor, and test performance.		
			30		Identify the terminals of sealed compressor and their wiring and measure current, volts, watts and use of DOL starter with different types of motors.		
			40		Perform selection of Hermetic compressor for different appliances, starting methods, testing controls & safety cut out used in sealed compressor.		

REFRIGERATION & AIR CONDITIONING PRACTICAL-1	**M 3. Components of refrigerator-evaporator, expansion devices and condensor. Refigerants**		25	M 3.1 Understand the working and maintenance of evaporator, condensor and expansion devices M 3.2 Know various refrigerants and their uses	Perform servicing & de-scaling of condenser (internals &externals) used in different appliances.		
			25		Perform fitting & adjustment of drier, filter & refrigerant controls used in different refrigeration system.		
			30		Perform servicing of different evaporator used in different appliances.		
			30		Carry out Recovery and Recycling of Refrigerant used, alternative of CFC, HFC re- cover, transfer & handling of gas cylinders.		
			30		Retrofit CFC/HFC machine with ozone friendly refrigerant with understanding of the compatibility.		
			20		Pack thermal insulation and prevent cooling leakage.		
			30		Perform servicing of evaporator & chillers.		
REFRIGERATION & AIR CONDITIONING PRACTICAL-1	**M 4. Installation, Service and maintanance of refigeration system**		30	M 4. 1 Understand service and maintenance of various refrigeration equipments.	Carry out servicing and retrofit of Water cooler and dispenser.		
			30		Service, retrofit of visible cooler and bottle cooler and test performance.		
			20		Conduct servicing of deep freezer and test performance.		
			20		Read and apply engineering drawing for different application in the field of work.		
			20		Demonstrate basic mathematical concept and principles to perform practical operations. Describe and explain basic science in the field of study.		
			75		Carry out servicing, dismantling, checking different parts of different types of commercial compressor, re-placing worn out parts, Check lubrication system. Assemble & check performance.		
			30		Perform servicing of different types of water- cooled condenser.		
			30		Perform servicing and performance test of Cooling tower.		
			30		Conduct Servicing, backwash & re-generate Water treatment plant of circulating water.		
			30		Perform Fitting of expansion valve, adjustment of refrigerant flow according to heat load.		
YEAR 2							

Employability Skills & Entrepreneurship (2001)	**Module M1** English & Communication	5	10	OB 1.1 To understand communication and self management skills OB 1.2 To understand English Literacy - functional English, reading & writing	MO-1.1 Demonstrate knowledge of various methods of communication - verbal, non-verbal-visual; Greetings & self introduction, Asking & responding to question, formal & informal communication MO-1.2 Demonstration of writing sentences and paragraphs on topics related to the subject, discussions on current happenings	- Lecture - Demonstration - Use of smart class rooms - Mock discussions, Interviews	- Laptop & Projector
	Module M2 Communication & Behavioral Skills	5	10	OB 2.1 To understand Behavioral skills - Personal strength analysis, social responsibility, role modeling	MO-2.1 Identify specific do's and don'ts for avoiding common body language mistakes MO-2.2 Execute time management and planning skills, Skills to crack interviews MO-2.3 Demonstration of impressive appearance and groomed personality, ability to self- explore MO-2.4 Display professionalism at the institute and workplace	- Lecture - Demonstration - Use of smart class rooms - Mock discussions, Interviews	- Laptop & Projector
	Module M3 Information Technology	20	40	OB 3.1 To understand Information and communication technology skills OB 3.2 To be familiar with internet and its applications	MO-3.1 Understand the basics of computers, Operating system, MS-Word, MS-Excel software's MO-3.2 Create simple documents like - resume, letter writing, job application etc., MO-3.3 Printing document, Familiar with usage of shortcuts, Creating and Editing of Text, Formatting the Text. MO-3.4 Use Web browsers and search engines, Creating & using e-mail id for communication	- Lecture - Demonstration - Use of smart class rooms	- Laptop & Projector

	Module M4 Entrepreneurship	25	5	OB 4.1 To understand Entrepreneurial skills	MO-4.1 Describe the significance of entrepreneurial values and attitude. MO-4.2 Demonstrate the knowledge of attitudinal changes required to become an entrepreneur MO-4.3 Explain the ways to set up an enterprise and different aspects involved viz., legal, compliances, Marketing aspect, Budgeting, etc	- Lecture - Demonstration - Use of smart class rooms	- Laptop & Projector
REFRIGERATION & AIR CONDITIONING THEORY (2071)							
REFRIGERATION & AIR CONDITIONING THEORY	**M 1. RAC systems, Repair and maintenanace.**	12		M 1.1 Understand installation, servicing and maintenance of Air conditioning systems. M 1.2 Know repairing and servicing of Ice candy plant, Ice cube machine etc.	Explain the procedure toInstall window AC, test Electrical & electronics components & Fault diagnosis & remedial measures.		
		6			Identify the components of control system of Inverter A.C and wiring of control system.		
		6			Explain servicing of electrical & electronic control test, installation, wiring, fault finding & remedial measures of different split AC.		
		5			Ouline servicing of car AC. Fault diagnosis & remedial measures.		
		5			Explain the procedure to Install, service, repair, gas charging and testing performance of Ice Cube machine.		
		5			Describe Repair, servicing & retrofit of ice candy plant.		
		6			Explain the procedure to Perform servicing of Ice plant and evaporative condenser.		
		9			Outline Servicing and preventive maintenance of walk in cooler & cold storage.		
REFRIGERATION & AIR	**M 2. Psychrometry, AC components**	12		M 2.1 Know psychrometry and properties of moist air. M 2.2 Understand installation, servicing and maintenance of Air conditioning components.	Sketch psychrometric chart and measure psychrometric properties using psychrometric, anemometer i.e. DBT, WBT, RH, air flow etc.		
		6			Explain the procedure to Perform servicing of motor and blowers used in different air conditioning system.		
		6			Explain the methods toConstruct, install, pack thermal and acoustic insulation of different air ducts.		

CONDITIONING THEORY	**Repair and maintenance.**	6			Outline servicing and maintenance of different types of air filters.		
		6			Explain servicing, installation, fault diagnosis and remedial measures on Package AC with Air cooled condenser.		
		15			Describe the procedure to Carry out Servicing, installation,fault diagnosis and remedial measures in Package A.C. with water cooled condenser.		
REFRIGERATION & AIR CONDITIONING THEORY	**M 3. Centralized AC system, components, Maintenance.**	6		M 3.1 Appreciate centralized air conditioning systems and its working. M 3.2 Comprehend advanced air conditing systems, components and their maintenance.	Illustrate the various components of central AC test electrical components and make wiring. Servicing of Air Handling Unit (A.H.U), damper, check air flow, De-scaling of condenser and Cooling tower servicing.		
		6			Describe the procedure to Pump down the system, top up oil and gas and check temperature and pressure.		
		6			Identify components of direct expansion system. Test components, make wiring of direct expansion system. Test leak and evacuate, gas charge the system and check the performance. Maintenance, trouble shoot and operate the plant.		
		6			Identify the different parts of VRF/VRV system, check and service VRF/VRV system.		
		6			Identify different parts of indirect or chillers system.Explain the procedure to Check components and make wiring, leak test, evacuate and gas charge/ top up. Servicing the plant and trouble shoot.		
		6			Identify chilled water pipe line. Servicing of dampers, FCU and water control valves.		
REFRIGERATION & AIR CONDITIONING THEORY	**M 4. Trouble shooting of AC systems, Practical applications**	12		M 4.1 Understand installation, maintenance and trouble shooting of AC systems. M 4.2 Use the aquired knowledge in RAC for various practical applications.	Explain the procedure to trouble shoot both Central A.C. plant DX and indirect system. Explain the procedure to Check different control system, installation of other major components, servicing of all parts including cooling tower and water treatment plant.		
		12			Outline Servicing, fault diagnosis, repair and maintenance of mobile A.C.leak test,evacuation, gas charging, check magnetic clutch and make wiring. Test performance after start.		
		12			Identify common problem related to IoT applications. Troubleshoot to resolve IoT software issues.Ensure the functionality using mobile app		

		9			Write and apply engineering drawing for different application in the field of work.		
		9			Write basic mathematical concept and principles to perform practical operations. Explain basic science in the field of study.		
		5			Perform preventive maintenance of different plants. Maintain log book based on daily operation.		
REFRIGERATION & AIR CONDITIONING PRACTICAL-2 (2079)							
REFRIGERATION & AIR CONDITIONING PRACTICAL-2	**M 1. RAC systems, Repair and maintenanace.**		45	M 1.1 Understand installation, servicing and maintenance of Air conditioning systems. M 1.2 Know repairing and servicing of Ice candy plant, Ice cube machine etc.	Install window AC, test Electrical & electronics components & Fault diagnosis & remedial measures.		
			45		Identify the components of control system of Inverter A.C and wiring of control system.		
			35		Perform servicing of electrical & electronic control test, installation, wiring, fault finding & remedial measures of different split AC.		
			35		Perform servicing of car AC. Fault diagnosis& remedial meas		
			35		Install, service, repair, gas charging and testing performance of Ice Cube machine.		
			35		Repair, servicing & retrofit of ice candy plant.		
			35		Perform servicing of Ice plant and evaporative condenser.		
			35		Perform Servicing and preventive maintenance of walk in cooler & cold storage.		
REFRIGERATION & AIR CONDITIONING PRACTICAL-2	**M 2. Psychrometry, AC components Repair and maintenance.**		35	M 2.1 Know psychrometry and properties of moist air. M 2.2 Understand installation, servicing and maintenance of Air conditioning components.	Study psychrometric chart and measure psychrometric properties using psychrometric, anemometer i.e. DBT, WBT, RH, air flow etc.		
			30		Perform servicing of motor and blowers used in different air conditioning system.		
			30		Construct, install, pack thermal and acoustic insulation of different air ducts.		
			30		Perform servicing and maintenance of different types of air filters.		
			45		Perform servicing, installation, fault diagnosis and remedial measures on Package AC with Air cooled condenser.		

			45		Carry out Servicing, installation, fault diagnosis and remedial measures in Package A.C. with water cooled condenser.		
REFRIGERATION & AIR CONDITIONING PRACTICAL-2	**M 3. Centralized AC system, components, Maintenance.**		45	M 3.1 Appreciate centralized air conditioning systems and its working. M 3.2 Comprehend advanced air conditing systems, components and their maintenance.	Identify the various components of central AC test electrical components and make wiring. Servicing of Air Handling Unit (A.H.U), damper, check air flow, De-scaling of condenser and Cooling tower servicing.		
			30		Pump down the system, top up oil and gas and check temperature and pressure.		
			40		Identify components of direct expansion system. Test components, make wiring of direct expansion system. Test leak and evacuate, gas charge the system and check the performance. Maintenance, trouble shoot and operate the plant.		
			40		Identify the different parts of VRF/VRV system, check and service VRF/VRV system.		
			40		Identify different parts of indirect or chillers system. Check components and make wiring, leak test, evacuate and gas charge/ top up. Servicing the plant and trouble shoot.		
			35		Identify chilled water pipe line. Servicing of dampers, FCU and water control valves.		
REFRIGERATION & AIR CONDITIONING PRACTICAL-2	**M 4. Trouble shooting of AC systems, Practical applications**		35	M 4.1 Understand installation, maintenance and trouble shooting of AC systems. M 4.2 Use the aquired knowledge in RAC for various practical applications.	Troubles shoot both Central A.C. plant DX and indirect system. Check different control system, installation of other major components, servicing of all parts including cooling tower and water treatment plant.		
			45		Perform Servicing, fault diagnosis, repair and maintenance of mobile A.C. leak test, evacuation, gas charging, check magnetic clutch and make wiring. Test performance after start.		
			35		Identify common problem related to IoT applications. Troubleshoot to resolve IoT software issues.Ensure the functionality using mobile app		
			35		Read and apply engineering drawing for different application in the field of work.		
			30		Demonstrate basic mathematical concept and principles to perform practical operations. Explain basic science in the field of study.		

			35		Perform preventive maintenance of different plants. Maintain log book based on daily operation.		
Project Work **(2008)**	1.Students Project Work	0	160	OB 1.1 To be familiar with industrial environment and production process	Employ skills acquired to solve problems of social significance or to simplifying day to day tasks.	- Demonstration - Industrial Visit	