



BANGLADESH TECHNICAL EDUCATION BOARD
Agargaon, Dhaka-1207

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

**REFRIGERATION & AIR-CONDITIONING
TECHNOLOGY**

TECHNOLOGY CODE: **672**

7th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

REFRIGERATION & AIR-CONDITIONING TECHNOLOGY (672)
7th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	67271	RAC System Analysis	2	3	3	40	60	25	25	150
2	67272	RAC Project	0	6	2	0	0	50	50	100
3	67273	Trouble shooting of RAC Equipment	2	3	3	40	60	25	25	150
4	67274	Transport Refrigeration And Air conditioning	3	3	4	60	90	25	25	200
5	67275	Commercial and Industrial Air conditioning	3	3	4	60	90	25	25	200
6	67276	Installation of RAC Plants	2	3	3	40	60	25	25	150
7	65853	Innovation & Entrepreneurship	2	0	2	40	60	0	0	100
Total			14	21	21	280	420	175	175	1050

67271

RAC System Analysis

T P C

2 3 3

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of refrigeration and air conditioning system analysis with special emphasis on:

- fundamentals of refrigeration and air conditioning system analysis.
- analysis of refrigeration cycle P-H diagram.
- analysis of psychometric process.
- analysis of absorption refrigeration system.
- PH chart analysis.

SHORT DESCRIPTION

Fundamentals of refrigeration and air conditioning system analysis; Analysis of vapor compression refrigeration system; Analysis of psychometric processes; Calculation of psychometric processes; Analysis of absorption refrigeration system; Analysis of air-conditioning system; Matching of components in vapor compression system. Analysis of solar cooling, environment friendly refrigerant, thermo-electric refrigeration, good practice in RAC etc.

DETAIL DESCRIPTION

Theory:

- 1 Understand the refrigeration and air conditioning system analysis.**
 - 1.1 Define refrigeration and air conditioning system analysis.
 - 1.2 Explain refrigeration and air conditioning system analysis.
 - 1.3 Explain P-V diagram for a normal substance.
 - 1.4 Explain of reversible and irreversible expansion of a liquid.
 - 1.5 Illustrate the method of calculation of enthalpy with the help of PH diagram.
 - 1.6 Explain reversed Carnot cycle and effect of operating temperature with T-S diagram.
 - 1.7 Explain Reversed Carnot cycle with T-S diagram using gas as a refrigerant.
 - 1.8 Explain the limitation of reversed Carnot cycle.

- 2 Understand the analysis of vapor compression refrigeration system.**
 - 2.1 Explain the effect of evaporator pressure with p-h diagram.
 - 2.2 Explain the effect of condenser pressure with p-h diagram.
 - 2.3 Explain the effect of the mechanical refrigeration cycle with the change of condenser cooling media.

- 2.4 Explain the effect of liquid sub cooling with p-h diagram.
- 2.5 Explain the effect of suction superheat with p-h diagram.
- 2.6 Solve problems on the effect of evaporator pressure, condenser pressure, liquid sub cooling, suction super heat liquid vapor regenerative heat exchanger etc of vapor compression refrigeration cycle.

3 Understand the analysis of psychometric processes.

- 3.1 Illustrate sensible heating and sensible cooling process in psychometric chart.
- 3.2 Explain the humidification and dehumidification process in psychometric chart.
- 3.3 Illustrate cooling and adiabatic humidification in psychometric chart.
- 3.4 Illustrate heating and humidification in psychometric chart.

4 Understand the calculation of psychometric processes.

- 4.1 Calculate the psychometric variables during sensible heating and sensible cooling process
- 4.2 Calculate the psychometric variable when two air streams are mixed.
- 4.3 Calculate the sensible heat factor during the psychometric process.
- 4.4 Solve problems to calculate dew point and apparatus dew point.

5 Understand the analysis of absorption refrigeration system.

- 5.1 Describe aqua ammonia absorption refrigeration cycle.
- 5.2 Explain elementary properties of binary mixture.
- 5.3 Explain rectification of binary mixture.
- 5.4 Explain practical single effect water lithium bromide absorption chillers.

6 Understand the analysis of air conditioning system.

- 6.1 Describe simple air conditioning system with mass and volume flow rate of supply air.
- 6.2 Explain summer air conditioning system with ventilation air bypass factor of certain amount.
- 6.3 Describe comfort air conditioning system and effect of its various psychometric processes using a psychometric chart.

7 Understand the matching of components in vapor compression system.

- 7.1 Illustrate the refrigerating capacity of a condensing unit.

- 7.2 Explain the refrigerating capacity versus evaporator temperature.
- 7.3 Illustrate the refrigeration capacity with the change in condensing and evaporating temperature.

8 Understand the analysis of environment friendly refrigerant.

- 8.1 Explain environment friendly refrigerant.
- 8.2 Explain harmful impact of CFC, HCFC refrigerant.
- 8.3 Outline disadvantages of HCFC refrigerant.
- 8.4 Outline alternative refrigerant and its characteristics.
- 8.5 Describe HC refrigerant.
- 8.6 Explain comparative characteristics of commonly used refrigerant (viz- R-12, R-22, R32, R-290, R-134a, R-600a, R-717,R-744).

9 Understand the analysis of thermo-electric refrigeration.

- 9.1 Explain thermo-electric refrigeration system.
- 9.2 Explain working principle of thermo-electric refrigeration system.
- 9.3 Describe the operation process of thermo-electric refrigeration.

10 Understand good practices in refrigeration and air conditioning works.

- 10.1 Explain necessity of good practices in RAC works.
- 10.2 Describe good practices in leak testing.
- 10.3 Describe good practices in gas charging.
- 10.4 State good practices in refrigerant recovery
- 10.5 Describe steps of installation and servicing a split type air conditioner following standard good practice.
- 10.6 Explain Limitations in installation, repair and servicing refrigerating equipment.

Practical:

- 1. Draw and solve problems on PH diagram using R-134a refrigerant at different conditions.
- 2. Draw and solve problems on PH diagram using R-600a refrigerant at different conditions.
- 3. Draw and solve problems on PH diagram using R-22 refrigerant at different conditions.
- 4. Draw and solve problems on PH diagram using R-410A refrigerant at different conditions.
- 5. Draw and solve problems on PH diagram using R-32 refrigerant at different conditions.
- 6. Draw and solve problems on PH diagram using R-290 refrigerant at different conditions.
- 7. Draw and solve problems on psychometric process of different air conditioning systems.
- 8. Draw and solve problems on psychometric process of summer air conditioning systems.
- 9. Draw and solve problems on psychometric process of comfort air conditioning systems.

10 Calculate the refrigerating capacity of compressor, condenser, evaporator when assembled together.

11 Calculate the refrigerating capacity of a plant that has assembled.

REFERENCE BOOKS

1. Refrigeration and Air Conditioning

- P L Ballaney.

2. Principles of Refrigeration

- R J Dossat.

3. A Text Book Of Refrigeration and Air Conditioning

- R S Khurmi & J K Gupta.

4. A Course in Refrigeration and Air conditioning

- SC Arora S Domkundwar.

5. Modern Refrigeration and Air-conditioning for Engineers

- Prof Desai

67272

RAC Project

T P C
0 6 2

AIMS

To provide the students with an opportunity to acquire skill in the area of refrigeration and air conditioning field with special emphasis on:

- design and estimate the project.
- select the appropriate material.
- build up structure of the model.
- prepare and present the project.
- build up structure model to make refrigeration/air-conditioning unit.
- present the project.

SHORT DESCRIPTION

Design & estimation of the project building/ constructing refrigeration and air conditioning equipment such as water cooler, domestic refrigerator model, split type air conditioner, chest freezer, commercial refrigeration unit, evaporative cooler, frost type & non-frost type refrigerator electric circuit.

DETAIL DESCRIPTION

1 Make a water cooler.

- 1.1 Design and estimate to make a model of water cooler.
- 1.2 Collect the spare parts & materials required.
- 1.3 Select air cooled condenser & evaporator, capillary tube and compressor.
- 1.4 Select compressor.
- 1.5 Select capillary tube.
- 1.6 Build up frame to install cooling coil, condenser & compressor.
- 1.7 Assemble the refrigeration components.
- 1.8 Evacuate the unit.
- 1.9 Perform leak test and evacuate the unit.
- 1.10 Charge refrigerant and test the performance.
- 1.11 Prepare & present a project report.

2 Make a model of domestic refrigerator-freezer.

- 2.1 Design and estimate to make a model of water cooler.
- 2.2 Collect the spare parts & materials required.
- 2.3 Select air cooled condenser & evaporator, capillary tube and compressor.
- 2.4 Select compressor.

- 2.5 Select capillary tube.
- 2.6 Build up frame to install cooling coil, condenser & compressor.
- 2.7 Assemble the refrigeration components.
- 2.8 Evacuate the unit.
- 2.9 Perform leak test and evacuate the unit.
- 2.10 Charge refrigerant and test the performance.
- 2.11 Prepare & present a project report.

3 Make an electric circuit for a frost type refrigerator and represent a wooden frame.

- 3.1 Design and estimate to make a model of water cooler.
- 3.2 Collect the spare parts & materials required.
- 3.3 Select air cooled condenser & evaporator, capillary tube and compressor.
- 3.4 Select compressor.
- 3.5 Select capillary tube.
- 3.6 Build up frame to install cooling coil, condenser & compressor.
- 3.7 Assemble the refrigeration components.
- 3.8 Evacuate the unit.
- 3.9 Perform leak test and evacuate the unit.
- 3.10 Charge refrigerant and test the performance.
- 3.11 Prepare & present a project report.

4 Make an electric circuit for a non-frost type refrigerator and represent a wooden frame.

- 4.1 Design and estimate to make a model of water cooler.
- 4.2 Collect the spare parts & materials required.
- 4.3 Select air cooled condenser & evaporator, capillary tube and compressor.
- 4.4 Select compressor.
- 4.5 Select capillary tube.
- 4.6 Build up frame to install cooling coil, condenser & compressor.
- 4.7 Assemble the refrigeration components.
- 4.8 Evacuate the unit.
- 4.9 Perform leak test and evacuate the unit.
- 4.10 Charge refrigerant and test the performance.
- 4.11 Prepare & present a project report.

5 Make a model of split type air conditioner.

- 5.1 Design and estimate to make a model of water cooler.
- 5.2 Collect the spare parts & materials required.

5.3 Select air cooled condenser & evaporator, capillary tube and compressor.

5.4 Select compressor.

5.5 Select capillary tube.

5.6 Build up frame to install cooling coil, condenser & compressor.

5.7 Assemble the refrigeration components.

5.8 Evacuate the unit.

5.9 Perform leak test and evacuate the unit.

5.10 Charge refrigerant and test the performance.

5.11 Prepare & present a project report.

6 Make a model of chest type freezer.

6.1 Design and estimate to make the model.

6.2 Select a chest type freezer of 200 to 300 liter.

6.3 Select a compressor, condenser, evaporator and capillary tube.

6.4 Build up a structure of the freezer.

6.5 Install all the components.

6.6 Weld & test for leak

6.7 Evacuate and charge refrigerant.

6.8 Select other electrical components.

6.9 Check performance.

6.10 Prepare & present a project report.

7 Make a demonstrating model of a refrigeration unit including capillary tube, automatic expansion valve, and thermostatic expansion valve in one refrigerating unit.

7.1 Design and estimate to make the model.

7.2 Collect the spare parts and material required.

7.3 Select the components for the project.

7.4 Assemble the parts and components.

7.5 Finally build up the project.

7.6 Prepare & present a project report.

8 Make a model of force draft/induced draft cooling tower.

8.1 Design and estimate to make the model.

8.2 Collect the spare parts and material required.

8.3 Select the components for the project.

8.4 Assemble the parts and components.

8.5 Finally build up the project.

8.6 Prepare & present a project report.

9 Make a model of evaporative cooler.

9.1 Design and estimate to make the model.

9.2 Collect the spare parts and material required.

9.3 Select the components for the project.

9.4 Assemble the parts and components.

9.5 Finally build up the project.

9.6 Prepare & present a project report.

10 Make a model central air-conditioning system.

10.1 Design, estimate to make a model of central AC plant.

10.2 Make a structure to install the components.

10.3 Make a structure to install the components.

10.4 Assemble the whole system.

10.5 Prepare and present a project report.

11 Make a model of thermo electric refrigeration system.

11.1 Design, estimate and select the materials with specification.

11.2 Collect the materials.

11.4 Select and collect tools and equipment.

11.5 Make supply duct model.

11.6 Prepare and present a project report.

67273 Trouble Shooting of RAC Equipment

T P C

2 3 3

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of trouble shooting and diagnosis of refrigeration and air conditioning equipment with special emphasis on:

- fault diagnosis, causes and remedies of refrigeration equipment when no symptom is given.
- fault diagnosis, causes and remedies of refrigeration equipment when symptoms are given.

SHORT DESCRIPTION

Common faults, causes and remedies of hermetic compressor, domestic refrigerator, freezers, window type air conditioner, self contained water cooled air conditioner, Split type air conditioner, light commercial system, industrial system employing an external drive compressor, ice flakers, car air conditioner and bus air conditioner.

DETAIL DESCRIPTION

Theory:

1 Understand common faults, causes & remedies of hermetic compressor.

1.1 Explain the causes of following trouble :

- a. Compressor does not start – no hum.
- b. Compressor does not start–hum intermittently.
- c. Compressor starts, motor does not get off starting winding.

1.2 Explain remedies of following trouble :

- a. Compressor does not start – no hum.
- b. Compressor does not start–hum intermittently.
- c. Compressor starts, motor does not get off starting winding.

2 Understand trouble, probable causes & remedies of domestic refrigerator & freezer.

2.1 Explain the causes of following trouble :

- a. Refrigerator fan does not start.
- b. Unit hums and shut off.
- c. Cooling unit runs excessively.
- d. Cabinet temperature too low.
- e. Suction line frosted.

2.2 Explain remedies of following trouble :

- a. Refrigerator fan does not start.
- b. Unit hums and shut off.
- c. Cooling unit runs excessively.
- d. Cabinet temperature too low.
- e. Suction line frosted.

3 Understand faults, causes and remedies of window / split type air conditioner.

3.1 Explain the causes of following trouble :

- a. Evaporator fan does not start.
- b. Compressor does not start.
- c. Unit runs but no cooling.
- d. Fuse blow just after start.
- e. Indoor unit running but outdoor unit does not work.
- f. Indoor unit frosted.

3.2 Explain remedies of following trouble :

- a. Evaporator fan does not start.
- b. Compressor does not start.
- c. Unit runs but no cooling.
- d. Fuse blow just after start.
- e. Indoor unit running but outdoor unit does not work.
- f. Indoor unit frosted.

4 Understand common complaints, possible causes & remedies of remote and self contained water cooled air conditioner.

4.1 Explain the causes of following trouble :

- a. Condensing unit motor blows fuses or trips circuit breaker.
- b. Compressor cycling on low pressure cut out.
- c. Compressor cycles on the high pressure cut out.
- d. Compressor operate at high suction pressure.
- e. Compressors operate at low suction pressure.
- f. Compressors operate at high head pressure.
- g. Compressors operate at low head pressure.

4.2 Explain the remedies of following trouble :

- a. Condensing unit motor blows fuses or trips circuit breaker.
- b. Compressor cycling on low pressure cut out.
- c. Compressor cycles on the high pressure cut out.
- d. Compressor operate at high suction pressure.
- e. Compressors operate at low suction pressure.
- f. Compressors operate at high head pressure.
- g. Compressors operate at low head pressure

5 Understand the common problems, possible causes and remedies of remote and split type air conditioner.

5.1 Explain the causes of following trouble :

- a. Air conditioner runs but less cooling.
- b. Inoperative remote control.
- c. Compressor starts and run but short cycle on overload protector.
- d. Space temperature too high.
- e. Liquid line frosted or sweating.

5.2 Explain the remedies of following trouble :

- a. Air conditioner runs but less cooling.
- b. Inoperative remote control.
- c. Compressor starts and run but short cycle on overload protector.
- d. Space temperature too high.
- e. Liquid line frosted or sweating.

6 Understand the faults, possible cuses and remedies of light commercial plants.

6.1 Explain the causes of following trouble :

- a. Thermostat does not cut off and not cut in.
- b. Compressor does not operate but appliance light bulb is on.
- c. Appliance runs continuously.
- d. Appliance runs continuously with no or little cooling.
- e. Defrost system water not drains, Ice or water draining in fresh food
Compartment.

6.2 Explain the remedies of following trouble :

- a. Thermostat does not cut off and not cut in.
- b. Compressor does not operate but appliance light bulb is on.

- c. Appliance runs continuously.
- d. Appliance runs continuously with no or little cooling.
- e. Defrost system water not drains, Ice or water draining in fresh food
Compartment.

7 Understand troubles, possible causes and remedies of industrial system employing an external drive compressor.

7.1 Explain the causes of following trouble :

- a. Compressor starts but cycles off on overload.
- b. Compressor starts but short cycles automatically.
- c. Open type compressor losses excessive amount of oil.
- d. Low evaporator capacity.
- e. Discharge pressure too high.
- f. Suction pressure too low.

7.2 Explain the remedies of following trouble :

- a. Compressor starts but cycles off on overload.
- b. Compressor starts but short cycles automatically.
- c. Open type compressor losses excessive amount of oil.
- d. Low evaporator capacity.
- e. Discharge pressure too high.
- f. Suction pressure too low.

8 Understand complaints, possible causes and remedies of ice flakers.

8.1 Explain the causes of following trouble :

- a. Compressor runs but no ice on bin.
- b. Compressor runs but condenser cooling fan does not run.
- c. Flakers cycle off and on frequently.

8.2 Explain the remedies of following trouble :

- a. Compressor runs but no ice on bin.
- b. Compressor runs but condenser cooling fan does not run.
- c. Flakers cycle off and on frequently.

9 Understand troubles, possible causes and remedies of central air conditioning plant.

9.1 Explain the causes of following trouble :

- a. Water cooled condenser pressure high.
- b. Condenser pressure low.
- c. Crankcase heater does not work.
- d. Low air circulation in the conditioned room.
- e. Noise level too high in AHU

9.2 Explain the remedies of following trouble :

- a. Water cooled condenser pressure high.
- b. Condenser pressure low.
- c. Crankcase heater does not work.
- d. Low air circulation in the conditioned room.
- e. Noise level too high in AHU

10 Understand the faults, possible causes and remedies of car air conditioner.

10.1 Explain the causes of following trouble :

- a. Noisy compressor.
- b. Improper cooling.
- c. Cool air comes out only at high speed.
- d. Insufficient air velocity.
- e. Bubbles and cloudy appearance in sight glass.

10.2 Explain the remedies of following trouble :

- a. Noisy compressor.
- b. Improper cooling.
- c. Cool air comes out only at high speed.
- d. Insufficient air velocity.
- e. Bubbles and cloudy appearance in sight glass.

Practical:

1. Detect faults and solve the problem of inactive refrigerator freezer.

- 1.1 Check power voltage in the socket.
- 1.2 Check power plug point for continuity/ resistance.
- 1.3 Check over load protector.
- 1.4 Check compressor motor.

1.5 Check thermostat.

1.6 Correct the fault.

2. Detect fault and repair when a ice cream cabinet runs but no cooling or less cooling.

2.1 Prepare process tube (charging line).

2.2 Connect high pressure gauge.

2.3 Apply Nitrogen pressure 150-180 psi.

2.4 Observe pressure drop.

2.5 Check for leak.

2.6 Prepare leak if any.

2.7 Evacuate the system.

2.8 Charge appropriate refrigerant.

2.9 Check the performance.

3. Detect fault and solve the problem when a compressor motor of window type air conditioner does not start.

3.1 Turn off the switch.

3.2 Remove the plug.

3.3 Remove the chassis.

3.4 Check capacitor.

3.5 Check compressor motor.

3.6 Check selector switch/ circuit.

3.7 Correct the fault.

4. Detect problem and rectify it when a semi sealed compressor of a commercial refrigeration unit short cycle.

4.1 Turn on the switch and check ampere.

4.2 Check LP cutout.

4.3 Check HP cutout.

4.4 Check thermostat.

4.5 Check solenoid valve.

4.6 Rectify the identified fault.

5. Detect the faults and rectify it when the suction pressure raises and decreases within a short time of a semi hermetic compressor of a commercial plant.

5.1 Check solenoid valve.

- 5.2 Check thermostat.
- 5.3 Check cooling fan.
- 5.4 Check chocking (Filter drier/ Expansion valve).
- 5.5 Solve the identified fault.

6. The condensing unit of a split type air conditioner does not start. Detect the fault and rectify it.

- 6.1 Check mode of operation.
- 6.2 Check compressor safety of the remote.
- 6.3 Check capacitor.
- 6.4 Check wiring.
- 6.5 Check magnetic contactor.
- 6.6 Check electronics circuit.
- 6.7 Solve the identified fault.

7. The finned coil of a non frost refrigerator is full of ice. Cold air is not blown /available.

Detect and rectify the fault.

- 7.1 Check fan.
- 7.2 Check door switch.
- 7.3 Check timer.
- 7.4 Check heater.
- 7.5 Check defrost thermostat.
- 7.6 Check thermal fuse.
- 7.7 Check water drain line.
- 7.8 Solve the identified fault.

8. The liquid indicator / sight glass of a car air conditioner shows bubbles some times and no flow at all. Detect the faults and rectify.

- 8.1 Check condenser.
- 8.2 Check fan motor.
- 8.3 Check filter drier if any.
- 8.4 Check for leak.
- 8.5 Change appropriate refrigerant.
- 8.6 Solve the identified fault.

9. The compressor of a non frost refrigerator freezer does not start for a long time

(no hum but the lamp light when the door is opened) detect the faults and rectify it.

- 9.1 Check thermostat.
- 9.2 Check timer.
- 9.3 Check for loose connection.
- 9.4 Solve the identified fault.

REFERENCE BOOKS

1. Modern Refrigeration and Air Conditioning
Althouse, Turnquist and Bracianno.
2. Refrigeration and Air Conditioning Technology
William C Whitman, William M Johnson.
3. Industrial and commercial refrigeration.
Nelson

67274 TRANSPORT REFRIGERATION & AIRCONDITONING

T P C

3 3 4

AIM

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of transport refrigeration and air conditioning with special emphasis on:

- refrigerated trucks and trailers
- trawler refrigeration
- car air conditioning
- bus air conditioning
- rail road car air conditioning
- ship air conditioning
- aero plane air conditioning
- MRT Air-Conditioning.

SHORT DESCRIPTION

- Concept of transport refrigeration and air conditioning; Refrigerated trucks and trailers; Trawler refrigeration; Car air conditioning systems; Compressor used in car air conditioning; Car air conditioning; Components of car air conditioning; Control and safety devices of car air conditioning systems; Servicing and maintenance of auto air conditioning; Bus air conditioning systems; Rail car air conditioning systems; Ship air conditioning systems; Aero plane air conditioning systems, MRT Air-Conditioning.

DETAIL DESCRIPTION

Theory:

- 1 Understand the concept of transport refrigeration and air conditioning.**
 - 1.1 State the meaning of transport refrigeration and air conditioning.
 - 1.2 Outline the importance of transport refrigeration and air conditioning.
 - 1.3 Identify the various transport refrigeration and air conditioning.
 - 1.4 List various non-mechanical transport refrigeration system.
 - 1.5 List various mechanical transport refrigeration and air conditioning system.
 - 1.6 Outlinethe advantages and disadvantages of non-mechanical transport refrigeration system.
- 2 Understand features of refrigerated trucks and trailers.**

- 2.1 Identify the various truck refrigeration system.
- 2.2 Describe the product sub-cooling in truck refrigeration system.
- 2.3 Describe the operation of expendable truck refrigeration system.
- 2.4 Describe the operation of eutectic solution in truck refrigeration system.
- 2.5 Describe the operation of self contained truck refrigeration system.

3 Understand the concept of trawler refrigeration.

- 3.1 Describe the refrigeration system of fishing trawler used for fishing near the shore.
- 3.2 Describe the refrigeration system of fishing trawler used for fishing at deep shore.
- 3.3 Describe the cooling system in trawler.

4 Understand the concept of car air conditioning systems.

- 4.1 State the purpose of automobile air conditioning.
- 4.2 Describe the refrigeration cycle of a car air conditioning system.
- 4.3 Distinguish between cycling and non-cycling compressors used in car air conditioning system.
- 4.4 Outline the importance of receiver used in car air conditioning system.
- 4.5 State the purpose of accumulator used in car air conditioning system.

5 Understand the features of compressors used in car air conditioning.

- 5.1 Outline the types of compressors used in car air conditioning system.
- 5.2 Outline the advantages of swash plate compressors over rotary compressor used in car air conditioning.
- 5.3 Outline the advantages of variable displacement swash plate compressor over fixed displacement swash plate compressor.
- 5.4 Outline the difference between scotch yoke compressor and scroll compressor.

6 Understand the features of components of car air conditioning.

- 6.1 Describe the construction of receiver drier used in car air conditioning.
- 6.2 List the expansion devices used in automotive air conditioning system.
- 6.3 Outline the advantages of heli-grip clutch over conventional type magnetic clutch.

7 Understand the concept of controls and safety devices of car air conditioning.

- 7.1 Identify the control and safety device used in air conditioning.
- 7.2 Describe the control of evaporator temperature by electric pressure switch.
- 7.3 Describe the control of evaporator temperature by the thermostatic cycling switch.
- 7.4 Describe the control of the evaporator temperature by suction pressure control valves.

7.5 Describe wiring system of the compressor clutch including all safety and control device.

8 Understand the servicing and maintenance of auto air conditioning system.

8.1 Describe sight glass indications for various conditions in the refrigeration system of auto air conditioner.

8.2 Describe the procedure of performance test of a car air conditioner.

8.3 Describe the charging process of refrigerant in a refrigeration cycle used in auto air conditioner.

9 Understand the concept of bus air conditioning system.

9.1 Describe the dual compressor refrigeration cycle of a bus air conditioning system.

9.2 Describe the different components of bus air conditioner refrigeration cycle.

9.3 Describe air distribution systems of bus air conditioner.

9.4 Outline typical specification of bus air conditioner.

10 Understand the concept of rail car air conditioning system.

10.1 State the compressor driving technique in rail car air conditioner.

10.2 Describe the cooling systems used in rail car air conditioner.

10.3 Describe the power systems of rail car air conditioner.

10.4 Describe the air distribution system of a rail car air conditioner.

11 Understand the concept of MRT air conditioning system.

11.1 State the meaning of MRT air conditioning system.

11.2 Outline the components used in refrigeration cycle used in MRT.

11.3 Describe the air circulation system used in MRT.

11.4 Point out the difference between rail car air conditioning and MRT air conditioning.

12 Understand the features of ship air conditioning.

12.1 Identify the components of refrigeration cycle of ship air conditioning systems.

12.2 Describe the air conditioning methods of ship air conditioning systems.

12.3 Describe the air distribution methods of ship air conditioning systems.

12.4 Describe ventilation requirement in ship air conditioning systems.

13 Understand the concept of aero plane air conditioning system.

13.1 Outline the heat sources of aero plane air conditioning.

13.2 State the factors to be considered in selecting refrigeration systems for aero plane air conditioning.

- 13.3 Describe different air cycles used in aero plane air conditioning systems.
- 13.4 Outline the advantages and disadvantages of air cooling system used in aero plane.

14 Understand the servicing of transport refrigeration and air conditioning system.

- 14.1 List the tools and equipment require for servicing transport refrigeration and air conditioning.
- 14.2 Describe the servicing procedure of condenser of a car air conditioner.
- 14.3 Outline the steps of replacing compressor of a car air conditioner.
- 14.4 Outline the process of servicing the cooling coil of transport refrigerating unit.

Practical :

1 Study the refrigeration cycle used in car air conditioning.

- 1.1 Identify the components of refrigeration cycle used in car air conditioning.
- 1.2 Start the refrigeration cycle.
- 1.3 Inspect the operation refrigeration cycle.

2 Study the air distribution system of car air conditioner.

- 2.1 Identify the components of air distribution systems used in car air conditioning.
- 2.2 Start the blower at different speed condition.
- 2.3 Operate the air conditioner at idle speed.
- 2.4 Start air conditioner at motion of car.

3 Study the car air conditioner compressor.

- 3.1 Identify the different components of a reciprocating compressor.
- 3.2 Identify the different components of a fixed displacement swash plate compressor.
- 3.3 Identify the different components of a variable displacement swash plate compressor.
- 3.4 Identify the different components of a scotch yoke type compressor.

4 Study the compressor clutch used in automobile air conditioner.

- 4.1 Identify the different type's magnetic clutches.

- 4.2 Test the clutch field coil.
- 4.3 Remove the clutch assembly.
- 4.4 Disassemble and assemble the clutch pulley assembly.
- 4.5 Install the clutch pulley assembly.
- 4.6 Start the compressor with the magnetic clutch.

5 Perform the service procedure of compressor used in car air conditioner

- 5.1 Isolate the compressor from the system.
- 5.2 Dismount the compressor.
- 5.3 Disassemble the compressor.
- 5.4 Replace compressor shaft seal.
- 5.5 Assemble the compressor.
- 5.6 Remount the compressor.
- 5.7 Connect the compressor with the refrigeration system.
- 5.8 Add oil to the compressor.
- 5.9 Start the compressor.

6 Study the electrical circuit of a car air conditioner.

- 6.1 Identify the components of electrical circuits of a car air conditioner.
- 6.2 Check the correct operation of the electrical components of electrical circuits of a car air conditioner.
- 6.3 Start and check the performance of the car air conditioner.

7 Study the service procedure of car air conditioners system.

- 7.1 Connect gage manifold into the refrigeration system of a car air conditioner.
- 7.2 Check for leak in the refrigeration system.
- 7.3 Evacuate the refrigeration system.
- 7.4 Charge refrigerant into the system if require.
- 7.5 Test the refrigeration system for correct charge.

8 Study the refrigeration system of a refrigerated van / Truck.

- 8.1 Identify the components of a conventional refrigeration cycle.
- 8.2 Identify the components of eutectic plate refrigeration system.
- 8.3 Cool the eutectic plate with power system in the charging station.

9 Study the bus air conditioning system.

- 9.1 Identify the components of refrigeration cycle used in bus air conditioning system.
- 9.2 Identify the components of air distribution system used in bus air conditioning.
- 9.3 Start the bus air conditioning system and observe the performance.

10 Study the service procedure of bus air conditioning system.

- 10.1 Connect gage manifold to the refrigeration system of bus air conditioner.
- 10.2 Measure the suction and discharge pressure for correct charge condition.
- 10.3 Diagnose the problems from side glass indications.
- 10.4 Detect leak in the refrigeration system if required.
- 10.5 Charge the refrigerant into the refrigeration system if require

11 Study the performance test of a car air conditioner.

- 11.1 Connect gage manifold to the refrigeration system.
- 11.2 Start the car air conditioning system.
- 11.3 Measure the suction and discharge pressure.
- 11.4 Measure the ambient and the discharge air temperature of the evaporator.
- 11.5 Compare the calculated performance with the manual.

REFERENCE BOOKS

1. Automotive Mechanics
– Crouse Anglin
2. Modern Refrigeration and Airconditioning
– Althouse/Turnquist/Braceiano
3. Basic Refrigeration and Air Conditioning
- Olive

67275 COMMERCIAL AND INDUSTRIAL AIR CONDITIONING

T P C

3 3 4

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of commercial and industrial air conditioning with the special emphasis on:

- concept and operation of central air conditioning system.
- DX and IDX Systems.
- features of absorption type central air conditioning plant.
- features of vapor compression type central air conditioning plant.
- piping system of central air conditioning plant.
- ducting system of central air conditioning plant.
- Air-conditioning System in Hotel.
- Commercial air conditioning system
- industrial air conditioning system.

SHORT DESCRIPTION

Concept of central air conditioning plant; Operation of central air conditioning plant; DX and IDX System of Air-Conditioning Plants. Absorption type central air conditioning plant; Piping systems of central plant; Ducting systems; Air conditioning systems of hotel; Different systems of industrial air conditioning plant; Acoustics & control of noises.

DETAIL DESCRIPTION

Theory:

- 1 Understand the concept of central air conditioning systems.**
 - 1.1 State the meaning of central air conditioning plant.
 - 1.2 Outline the classification of central air conditioning plants.
 - 1.3 State each type of central air conditioning plant.

- 2 Understand the concept of DX system of central air conditioning plant.**
 - 2.1 State the meaning of DX system.

- 2.2 Outline the components refrigeration cycle of DX system of central air conditioning plant.
- 2.3 State the function of each component of DX system used in air conditioning plant.
- 2.4 State the limitation of DX system used in central air conditioning plant.

3 Understand the operation of IDX system used in central air conditioning plant.

- 3.1 State the meaning of IDX system.
- 3.2 Outline the components refrigeration cycle of IDX system of central air conditioning plant.
- 3.3 State the function of each component of IDX system used in air conditioning plant.
- 3.4 State the limitation of IDX system used in central air conditioning plant.
- 3.5 Outline the advantage and disadvantages of IDX system over DX system.

4 Understand the features of absorption type central air conditioning plant.

- 4.1 List the components of lithium bromide & water type central air conditioning plant.
- 4.2 State the function of each component of lithium bromide and water type absorption system.
- 4.3 Illustrate the lithium bromide and water type absorption system.
- 4.4 State the advantages and disadvantages of lithium bromide & water type absorption system over centrifugal water chiller for central air conditioning plant.

5 Understand the features of compressors used in central air conditioning plant.

- 5.1 Outline the type of compressors used in central air conditioning plant.
- 5.2 State the advantage and disadvantages of centrifugal compressor over screw type compressor used in central plant.
- 5.3 State the advantage and disadvantages of reciprocating compressor over screw compressor when used in central air conditioning.
- 5.4 State the limitation of use of reciprocating compressor in central air conditioning plant.

- 6 Understand the piping systems of a central air conditioning plant.**
- 6.1 List different piping systems of a central air conditioning plant.
 - 6.2 Describe with diagram the refrigeration cycle of a centrifugal water chiller.
 - 6.3 Illustrate the chilled water circulating system of a centrifugal water chiller.
 - 6.4 Describe with diagram the chilled water circulating system of a reciprocating water chiller.
- 7 Understand the ducting system of a centrifugal water chiller.**
- 7.1 Describe with diagram the air distribution system of a cinema hall.
 - 7.2 Explain the cooled air distribution systems of an auditorium.
 - 7.3 Illustrate the ventilating duct of a textile mill.
 - 7.4 Explain with diagram the ventilating ducting system of a public toilet.
 - 7.5 Describe with diagram the air distribution system of a super store.
- 8 Understand the air conditioning system of a hotel.**
- 8.1 State the factors to be considered for selecting air conditioning plant for an international hotel.
 - 8.2 Describe with diagram the air cooling system of hall/ball room of a hotel.
 - 8.3 Illustrate with diagram chilled water piping system of an international hotel.
 - 8.4 Describe with diagram the condensate drainage system of an air conditioning plant of a hotel.
- 9 Understand different systems of Commercial air conditioning plant.**
- 9.1 State the purposes of central air conditioning plant in Commercial super market.
 - 9.2 Describe with diagram the air cooling system.
 - 9.3 Illustrate the air cooling system of a super market.
 - 9.4 Explain with diagram the condensate drainage system of a super market.
- 10 Understand different systems of industrial air conditioning plant.**
- 10.1 State the purposes of air conditioning in industry.
 - 10.2 Describe the humidification method in industrial air conditioning plant.
 - 10.3 Explain the dehumidification method used in industry.
 - 10.4 Illustrate the hot air removal from the textile mill/garments industry.

- 11 Understand the concepts of acoustics and control of noises.**
- 11.1 State the meaning of the term acoustics.
 - 11.2 Name some sound absorption materials.
 - 11.3 Describe the principles and practices of noise attenuation in pipes and ducts of air conditioning systems.
 - 11.4 Describe the methods of reducing the noise generated by the AHU, FCU, compressor, pump motor set etc.
- 12 Understand the operation of centrifugal water chiller used in central air conditioning plant.**
- 12.1 Outline the components of refrigeration cycle of centrifugal water chiller.
 - 12.2 List all the variables of a running air conditioning plant(Viz: pressure ,temperature, ampere, voltage).
 - 12.3 Describe the operating procedure of centrifugal water chiller used in central air conditioning plant.
- 13 Understand the air distribution system of central air conditioning plant.**
- 13.1 Outline the component/equipment of air distribution system of central air conditioning plant.
 - 13.2 Describe the method of air supply/distribution system with diagram.
 - 13.3 Describe the use of return and fresh air in central air conditioning plant.
 - 13.4 Describe the air filtration system used in air conditioning system.
- 14 Understand the features of vapor compression type central air conditioning plant.**
- 14.1 State the function of each component of vapor compression type central air conditioning plant.
 - 14.2 Outline differences between DX and IDX system central air conditioning plant.
 - 14.3 Outline the advantages and disadvantages of Central DX and IDX air conditioning plant.
- 15 Understand the pumps used in central air conditioning plant.**
- 15.1 State the necessity of pump use in central air conditioning plant.
 - 15.2 Illustrate the water circulation system of central air conditioning plant.
 - 15.3 Illustrate the water circulation system of cooling tower used in central air conditioning plant.

Practical:

- 1. Draw refrigeration cycle of a centrifugal water chiller.**
 - 1.1 List the components of refrigeration cycle.
 - 1.2 Locate each component of refrigeration cycle.
 - 1.3 Draw the refrigeration cycle of centrifugal water chiller using standard symbol.
- 2. Draw condenser cooling water piping diagram of a centrifugal water chiller.**
 - 2.1 List the components of refrigeration cycle.
 - 2.1 Locate each component of refrigeration cycle.
 - 2.3 Draw the refrigeration cycle of centrifugal water chiller using standard symbol.
- 3. Draw the chilled water piping diagram of a centrifugal water chiller.**
 - 3.1 List the components of refrigeration cycle.
 - 3.2 Draw the refrigeration cycle of centrifugal water chiller using standard symbol.
 - 3.3 Locate each component of refrigeration cycle.
- 4. Draw the piping diagram of absorption type water chiller.**
 - 4.1 List the components of refrigeration cycle.
 - 4.2 Draw the refrigeration cycle of centrifugal water chiller using standard symbol.
 - 4.3 Locate each component of refrigeration cycle.
- 5. Visit a centrifugal water chiller of a central air conditioning plant.**
 - 5.1 List the major component of a central air conditioning plant which use centrifugal compressor.
 - 5.2 Record the plant capacity, number of compressor, condenser, expansion device, evaporator with capacity.
 - 5.3 Record the operating pressure of compressor and oil pump.
 - 5.4 Draw the water cycle of centrifugal water chiller of central air conditioning plant.
- 6. Visit an absorption type central air conditioning plant.**
 - 6.1 List the major component of an absorption type central air conditioning plant.
 - 6.2 Record all the variables of the plant.
 - 6.3 Calculate the plant capacity and compare with the mechanical system.
 - 6.4 Prepare report of the plant visited.
- 7. Visit a super market that has central air conditioning plant.**
 - 7.1 List the major component of an absorption type central air conditioning plant.
 - 7.2 Record all the variables of the plant.
 - 7.3 Record specification of the plant.
 - 7.4 Prepare report of the plant visited.
- 8. Visit an air condition cinema hall.**

8.1 List the major component of an absorption type central air conditioning plant.

8.2 Record all the variables of the plant.

8.3 Record specification of the plant.

8.4 Prepare report of the plant visited.

9. Visit an ice cream factory.

9.1 List the major component of an absorption type central air conditioning plant.

9.2 Record all the variables of the plant.

9.3 Record specification of the plant.

9.4 Prepare report of the plant visited.

10. Measure sound level of different components of air conditioning plant and compare with the acceptable level of noise.

10.1 Measure the sound level of compressor motor set.

10.2 Measure the sound level of pump motor set.

10.3 Measure the sound level of cooling tower.

10.4 Measure the sound level of AHU.

7.5 prepare a report mentioning the sound level exceeds the normal db.

REFERENCE BOOKS

1. Commercial and Industrial Refrigeration
– Nelson.
2. A Text Book of Refrigeration and Air conditioning
– R S Khurmi.
3. A Course in Refrigeration and Air conditioning
– S C Arora S Domkundwar.

67276 INSTALLATION OF RAC PLANTS

T P C

2 3 3

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of installation of refrigeration and air conditioning plants with special emphasis on:

- insulating materials used in refrigeration and air conditioning installation
- installation of refrigeration and air conditioning components
- installation of split type air-conditioner
- installation of cold storage equipment
- Installation of multiple temperature unit

SHORT DESCRIPTION

Concept of refrigeration and air-conditioning plant installation; Insulating materials; Installation of compressor; Installation of condenser; Installation of evaporator; Installation of split type air conditioner; Installation of ice cream factory; Installation of cold storage; Multiple unit installation; Installation of air-conditioning plant.

DETAIL DESCRIPTION

Theory:

1 Understand the concept of refrigeration and air-conditioning plant installation.

- 1.1 State the meaning of installation of a refrigeration plant.
- 1.2 Outline the importance of proper installation of refrigeration and air-conditioning plant.
- 1.3 Outline the types of installation of refrigeration & air-conditioning plant.
- 1.4 Describe the different types of installation of commercial refrigeration and air conditioning plant.

2 Understand the insulating materials used in refrigeration and air conditioning installation.

- 2.1 State what is meant by thermal insulation.
- 2.2 Outline the importance of thermal insulation in refrigeration and air conditioning work.
- 2.3 Outline the different types of insulating materials.
- 2.4 Describe the properties of insulating materials.

2.5 Outline the economic insulation thickness.

3 Understand the installation of compressor in refrigeration and air conditioning plant.

3.1 Outline the factors to be considered to install a open type compressor.

3.2 Outline the steps of installation of a open type compressor.

3.3 Describe the procedure of preparing foundation to install a open type compressor motor.

3.4 Describe the alignment checking procedure of a installed compressor.

3.5 Describe the vibration minimizing methods of a compressor.

4 Understand the concept of condenser installation.

4.1 Outline the factors to be considered to install a remote air-cooled condenser.

4.2 Outline the steps of installation of a shell & tube condenser.

4.3 Outline the steps of installation of an atmospheric type condenser

5 Understand the concept of evaporator installation.

5.1 Outline the factors to be considered to install an evaporating unit.

5.2 Outline the steps to install a force type evaporator.

5.3 Describe the condensate drainage procedure of a finned coil evaporator.

6 Understand the concept of installation of water pump-motor set used in refrigeration and air-conditioning plant.

6.1 Outline the factors to be considered in selecting the location of the condenser cooling water circulating pump.

6.2 Describe the installation process of a chilled water circulating pump- motor set.

6.3 Describe the alignment checking procedure of a chilled water circulating pump-motor set.

7 Understand the concept of installation of a split type air conditioner.

7.1 Outline the steps to install a out door unit of a split type air-conditioned.

7.2 Outline the steps to install a indoor unit of a split type air conditioner.

7.3 Describe the piping connection procedure of a split type air conditioner when the outdoor unit is installed above the indoor unit.

7.4 Describe the procedure of piping of a split type air conditioner when the outdoor unit is installed below the indoor unit.

7.5 Describe the procedure of piping insulation of a split type air-conditioner when expansion device use in outdoor unit.

7.6 Outline the distance limitation between the outdoor and indoor unit of a split type air conditioner.

8 Understand the concept of installation of an ice cream factory.

8.1 Describe the installation procedure of a condensing unit of ice cream factory.

8.2 Describe the installation procedure of a cooling unit of ice cream factory.

8.3 Describe the pipe/tube installation of ice cream factory.

9 Understand the concept of installation of cold storage equipment.

9.1 Describe the wall insulating method of a potato preserving cold storage.

9.2 Describe the installation procedure of cooling unit of a potato preserving cold Storage.

9.3 Describe the installation method of suction riser and discharge riser.

9.4 Describe the installation method of piping of condenser to receiver.

10 Understand the concept of multiple unit installation.

10.1 Outline the important points to be considered for multiple temperature unit installation.

10.2 Describe the installation method of suction line when the evaporator is located above and below the compressor.

10.3 Describe the installation method of multiple evaporators for individual suction line and common suction line when installed in same level.

10.4 Describe the installation method of discharge and suction piping for compressors connected in parallel.

10.5 Describe the installation method of a condenser cooling water piping system.

11 Understand the installation of air conditioning plant.

11.1 Describe the procedure of installation of an AHU.

11.2 Describe the procedure of installation of an air filter.

11.3 Describe the procedure of installation of a fan coil unit (FCU).

11.4 Describe the procedure of installation of cooling tower.

Practical:

1 Perform the wall insulation of a cold storage.

1.1 Make wall preparation to insulate a wall.

1.2 Apply bitumen on the wall and on the insulating material.

1.3 Fix insulating material on the wall.

1.4 Make wire netting on the insulation of the wall.

1.5 Perform plastering on wire net of the insulated wall.

2 Perform the installation of a externally driven compressor motor set.

- 2.1 Make an angle frame of iron to install an externally driven commercial compressor.
- 2.2 Make holes on the angle frame of iron to install the compressor.
- 2.3 Make holes on the frame to install the motor with adjustment facilities.
- 2.4 Perform floor preparation to fix the angle frame of iron.
- 2.5 Install compressor and motor on the angle frame of iron.
- 2.6 Align the compressor motor set.
- 2.7 Adjust belt tension.

3 Perform the installation of a shell & tube type condenser.

- 3.1 Make floor preparation to install the condenser.
- 3.2 Put the condenser on the prepared floor.
- 3.3 Fix the condenser with anchor bolts.

4 Perform the installation of a fan coil unit.

- 4.1 Make ceiling preparation to install the fan coil unit.
- 4.2 Put the fan coil unit with the ceiling.
- 4.3 Fix the fan coil unit.
- 4.4 Wire and test fan coil unit.

5 Perform the installation of water pump set.

- 5.1 Make an angle frame of iron to install pump motor set.
- 5.2 Make holes on the angle frame to install the pump motor set.
- 5.3 Make the floor preparation to install a prepared iron angle frame.
- 5.4 Fix the iron angle frame on the floor.
- 5.5 Install the pump motor set on the iron angle frame.
- 5.6 Align the pump motor set.

6 Perform the installation of split type air conditioner.

- 6.1 Prepare angle frame of iron for cantilever mount outdoor unit of a split type air conditioner.
- 6.2 Fix the angle frame on appropriate place.
- 6.3 Install the outdoor unit on the iron angle frame
- 6.4 Install the indoor unit with the ceiling.
- 6.5 Connect refrigerant tubes between the outdoor and the indoor unit.
- 6.6 Perform the wiring.
- 6.7 Start up and check the unit.

7 Visit a cold storage and make a report about installation.

8 Visit a central air conditioning plant and make a report about installation.

9 Visit a potato cold storage:

9.1 Record all variables (Viz- pressure, temperature, humidity, voltage, current, water flow etc.)

9.2 Show in drawing the discharge lines of compressors connection with header.

9.3 Level all components.

REFERENCE BOOKS

1. Modern Refrigeration and Air-conditioning
-Althouse / Turnquest / Bracciano
2. Principle of Refrigeration
-Roy J. Dossat
3. Refrigeration and Air-conditioning
-William C Whitman
-William M Johnson

AIMS

- To be able to understand the concept of entrepreneurship & entrepreneur.
- To be able to understand the concept of environment for entrepreneurship.
- To be able to understand the sources of venture ideas in Bangladesh.
- To be able to understand the project selection.
- To be able to understand business planning.
- To be able to understand the insurance and premium.
- To be able to understand the MDG & SDG.

SHORT DESCRIPTION

Concepts of entrepreneurship & entrepreneur; Entrepreneurship & economic development; Environment for entrepreneurship; Entrepreneurship in the theories of economic growth; Sources of ventures ideas in Bangladesh; Evaluation of venture ideas; Financial planning; Project selection; Self employment; Entrepreneurial motivation; Business plan; Sources of assistance & industrial sanctioning procedure; Concept of SDG; SDG 4,8 .

DETAIL DESCRIPTION

Theory :

1. Understand the basic concept of entrepreneurship & entrepreneur.

- 1.1 Define entrepreneurship & entrepreneur.
- 1.2 Discuss the characteristics and qualities of an entrepreneur.
- 1.3 Mention the classification of entrepreneur.
- 1.4 Discuss the necessity of entrepreneurship as a career.
- 1.5 Discuss the prospect of entrepreneurship development in Bangladesh.

2. Understand the concept of entrepreneurship and economic development.

- 2.1 Define economic development.
- 2.2 Discuss the economic development process.
- 2.3 Discuss the capital accumulation or rate of savings.
- 2.4 Discuss the role of entrepreneur in the technological development and their introduction into production Process.
- 2.5 Discuss the entrepreneur in the discovery of new product.
- 2.6 Discuss the discovery of new markets.

3. Environment for entrepreneurship development:

- 3.1 Define the micro environment.
- 3.2 Discuss individual income, savings and consumption.
- 3.3 Define macro environment.
- 3.4 Discuss political, socio-cultural, economical, legal and technological environment.
- 3.5 Difference between micro and macro environment .

4. Understand the concept of entrepreneurship in the theories of economic growth.

- 4.1 Define entrepreneurship in the theories of economic growth.
- 4.2 Discuss the Malthusian theory of population and economic growth.
- 4.3 Discuss the stage theory of growth.
- 4.4 Discuss the Schumpeterian theory of economic development.
- 4.5 Discuss the entrepreneurship motive in economic development.

5. Understand the sources and evaluation of venture ideas in Bangladesh.

- 5.1 Define sources of venture ideas in Bangladesh.
- 5.2 Discuss different types of sources of venture ideas in Bangladesh.
- 5.3 Define evaluation of venture ideas.
- 5.4 Discuss the factors that influence the selection of venture idea.

6. Understand the concept of project selection and financial planning.

- 6.1 Define project.
- 6.2 Discuss the idea of project.
- 6.3 Describe the guide lines for project ideas.
- 6.4 Discuss the sources of project ideas.
- 6.5 Discuss the evaluation of project ideas.
- 6.6 Describe the technical aspect of project.
- 6.7 Define financial planning.
- 6.8 Discuss the long term financial plan.
- 6.9 Discuss the short term financial plan.

7. Understand the concept of self employment.

- 7.1 Define self employment.
- 7.2 Describe different types of employment.
- 7.3 Describe the importance of business as a profession.
- 7.4 Discuss the reasons for success and failure in business.

8. Understand the business plan and the concept of the environment for entrepreneurship.

- 8.1 Define business plan.
- 8.2 Describe the importance of business plan.
- 8.3 Discuss the contents of business plan.
- 8.4 Define environment of business.
- 8.5 Describe the factors which effect environment on entrepreneurship

9. Understand the concept of sources of assistance & industrial sanctioning procedure.

- 9.1 Define sources of assistance.
- 9.2 Describe different types of sources of assistance.
- 9.3 Discuss the aid of sources.
- 9.4 Discuss the industrial policy.
- 9.5 Define foreign aid.

10. Understand the insurance and premium.

- 10.1 Define insurance and premium
- 10.2 Describe the essential conditions of insurance contract.
- 10.3 Discuss various types of insurance.
- 10.4 Distinguish between life insurance and general insurance.

11. Understand the concept of Sustainable Development Goals (SDG)

- 11.1 Define Sustainable development
- 11.2 State UN targets of MDG
- 11.3 State UN targets of SDG
- 11.4 Describe the importance of SDG
- 11.5 Explain the objectives of SDG
- 11.6 State the Challenges to achieve SDGs
- 11.7 Explain the actions to face the challenges of SDGs
- 11.8 State the of 7th 5 years plan
- 11.9 Mention the link of 7th 5 years plan with SDGs
- 11.10 Write down the 5 ps of sustainable development goals

12. Understand SDG 4,8 and 17

- 12.1 Describe SDG 4 and its targets
- 12.2 State the elements of Quality education for TVET
- 12.3 Describe the gender equality and equal access of TVET for economic growth
- 12.4 Describe SDG 8 and its targets
- 12.5 Explain Green development, Green Economy, Green TVET & Green Jobs
- 12.6 Explain the role an entrepreneur for achieving SDG

Reference book :

1. A hand book of new entrepreneur-by p.c jain.
- 2.A manual on business opportunity Identification and selection-by j.B patel and S S modi.
- 3.Uddokta unnoyan Nirdeshika -Md.Sabur khan.
- 4.Entrepreneurship- bashu and mollik.
- 5.Business Entrepreneurship-kage faruke.
6. Website, Youtube and Google