



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

QUESTION BANK

Course Name	:	THERMAL ENGINEERING-I
Course Code	:	A40313
Class	:	II B. Tech II Semester
Branch	:	Mechanical Engineering
Year	:	2016 – 2017
Course Faculty	:	Mr. S.V. Durga Prasad, Associate Professor, Ms. N. Santhi Sree, Associate Professor

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner’s learning process.

S.No	Questions	Blooms Taxnomy level	course outcome
UNIT-I			
I C ENGINES FUNDAMENTALS			
PART-A SHORT ANSWER QUESTIONS			
1	What is valve timing diagram why the inlet valve is opened before TDC and closed after BDC?	creating	6
2	What is combustion efficiency and combustion back duration?	Analyzing	4
3	What is fluid friction in an engine?	Analyzing	4
4	What are the products formed during combustion process	Understanding	2
5	What is an internal combustion engine?	Understanding	2
6	What is scavenging?	Remembering	1
7	What is meant by compression ratio?	Evaluating	5
8	Define firing order	Remembering	1
9	What do you mean by SFC	Remembering	1
10	Define mean effective pressure.	Remembering	1
11	List the advantages of valve timing diagram?	Understanding	2
12	What is stoichiometry?	Analyzing	4
13	Stoichiometric air-fuel ratio means?	Remembering	1
14	What are the fuel injection systems?	Understand	2
15	Differentiate cooling system and lubrication system.	Understanding	2
16	Give the required properties of good fuel?	Remembering	1
17	What is combustion stoichiometry?	Evaluating	5
18	What is indicator diagram?	Remembering	1

19	What is the difference between indicator diagram and valve timing diagram?	Remembering	1
20	Differentiate valve and port?	Remembering	1

UNIT-I

PART-B LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxnomy level	course outcome
1	Give classification of IC Engines.	Understanding	2
2	Distinguish between SI engines and CI engines?	Analyzing	4
3	Sketch and explain the valve timing diagram of a four stroke Otto cycle?	Analyzing	4
4	In what respect two stroke engines differs from 4-stroke engine Discuss?	Analyzing	4
5	Explain fuel injection system of an SI engine?	Understanding	2
6	What are the different lubrication systems available for IC engines?	Analyzing	4
7	Discuss the importance of cooling system for an IC engines. Describe different cooling systems?	Understanding	2
8	List out the properties of fuel for (i) SI engine (ii) CI engine.	Analyzing	4
9	Explain lubrication system for IC engines?	Applying	3
10	Explain cooling system for IC engines?	Understanding	2
11	what is scavenging ? explain with sketches?	Understanding	2
12	List the factors causes detonation and explain in detail?	Analyzing	4
13	Explain Magneto ignition system with a neat diagram?	Analyzing	4
14	Explain coil ignition system with a neat diagram?	Analyzing	4
15	What is Octane number? What is the role of Octane number in the performance of engine? For higher performance of engine which rated fuels are to be selected?	Applying	3
16	Explain Battery ignition system with a neat diagram?	Applying	3
17	Name two general classes of combustion engines and state how do they basically differ in principle?	Analyzing	4
18	What are the two basic types of internal combustion engines? What are the fundamental differences between the two?	Analyzing	4
19	Discuss the relative advantages and disadvantages of IC engines and external combustion engines?	Analyzing	4
20	What is the function of a governor? Enumerate the types of governors? Sketch the porter governor with a neat sketch?	Applying	3

UNIT-II

COMBUSTION IN SI AND CI ENGINES

PART-A SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxnomy level	course outcome
1	What is the normal combustion and abnormal combustion in SI engine?	Understanding	2
2	What is called flame front and flame velocity?	Understanding	2
3	What is knocking in both SI and CI engines?	Analyzing	4
4	What decides severity of knocking in both SI and CI Engines?	Analyzing	4
5	What is pre ignition and optimum ignition timing?	Analyzing	4
6	What is ignition delay period?	Remembering	1
7	Define suction induced swirl and combustion induced swirl?	Analyzing	4
8	What is mixture strength? How it influences the combustion?	Analyzing	4
9	What are anti knock agents? Main difference between working of anti knock agent in SI and CI ENGINES?	Analyzing	4
10	What is a combustion chamber? What are the different combustion zones in combustion chamber?	Analyzing	4
11	What are the types of ignition systems?	Understanding	2
12	Give the two methods of cooling systems?	Understanding	2

13	List the properties of lubricants?	Remembering	1
14	Factors affecting normal combustion in SI system?	Analyzing	4
15	What are the properties of liquid fuels?	Remembering	1
16	What are the tests for identifying pre-ignition?	Analyzing	4
17	Differentiate auto ignition and detonation?	Analyzing	4
18	What are the effects of detonation?	Analyzing	4
19	How to control detonation?	Analyzing	4
20	Draw the pressure - crank angle diagram of petrol engine?	Understanding	2
21	What is turbulence? Squish and Tumble?	Understanding	2

UNIT-II

PART-B LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxnomy level	course outcome
1	State and explain different combustion stages in SI engine?	Evaluating	5
2	State and explain different combustion stages in CI engine?	Understanding	2
3	Explain knocking, properties and its effects in CI engine?	Understanding	2
4	Explain different types of combustion chambers in SI and CI engines?	Evaluating	5
5	Explain the need for air motion and types?	Analyzing	4
6	Factors influencing knocking in SI and CI engine?	Analyzing	4
7	Differentiate between normal combustion and abnormal combustion phenomena incase of SI Engine.	Analyzing	4
8	What is the importance of variables like flame speed flame front in case of delay period.	Analyzing	4
9	Explain knocking additives.	Understanding	2
10	Discuss air flow movements in CI engines	Understanding	2
11	Explain the Splash lubrication system with the diagram?	Evaluating	5
12	Explain the carburetor working principle with diagram?	Understanding	2
13	What are the types of fuel injection systems? Explain any one with a neat sketch?	Understanding	2
14	How to tell a two stroke cycle engine from a 4 stroke cycle engine?	Evaluating	5
15	Explain the Pressure feed system with a diagram?	Analyzing	4
16	In what respect four-stroke diesel cycle(compression Ignition) engine differs from four stroke cycle spark ignition engine?	Analyzing	4
17	What do you mean by Pre-ignition? How can it be detected?	Analyzing	4
18	Explain the difference between Pre-ignition, auto-ignition and detonation?	Analyzing	4
19	What is meant by ignition delay? Explain the steps in SI engines ignition delay?	Analyzing	4
20	Why do we feel the necessity of cooling an IC engine? Explain briefly the following methods of cooling IC engines: Air-cooling and Liquid - cooling?	Analyzing	4

UNIT-III

TESTING AND PERFORMANCE

PART-A SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxnomy level	course outcome
1	Define brake power	Analyzing	4
2	Define mechanical efficiency	Analyzing	4
3	List the devices used to measure the cylinder pressure.	Understanding	2
4	What is an indicated power	Understanding	2
5	What are the various losses of IC Engine?	Understanding	2
6	How do you determine heat losses explain with sankey diagram?	Create	6
7	Define clearance ratio.	Analyzing	4
8	What is the function of air compressor?	Analyzing	4
9	Define Isothermal work done	Understanding	2

10	What is volumetric efficiency in case of compressor?	Understanding	2
11	What is the use of heat balance sheet of an engine?	Analyzing	4
12	What is specific fuel consumption?	Analyzing	4
13	Define volumetric efficiency?	Understanding	2
14	What is the purpose of engine testing?	Understanding	2
15	What are the performance parameters for testing engines?	Analyzing	4
16	For what purpose rope brake dynamometer used? Draw the diagram?	Creating	6
17	What is the Morse test importance?	Analyzing	4
18	What is the clearance in the compressor? What are the advantages of clearance?	Analyzing	4
19	What is the efficiency of compressor?	Understanding	2
20	Draw the PV-diagram for two stage compressors? What is the advantage?	Understanding	2

UNIT-III

PART-B LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxonomy level	course outcome
1	Explain the Morse test ?	Understanding	2
2	What is wilan's line .how do you measure frictional power using this.	Analyzing	4
3	Discuss different types of dynamometers.	Understanding	2
4	Write short notes on Exhaust gas analysis	Applying	3
5	Derive volumetric efficiency of air compressor	Understanding	2
6	Classify compressors	Understanding	2
7	Explain Isothermal work done	Understanding	2
8	Derive equation for workdone of reciprocating air compressor with T-S and p-V diagrams	Creating	6
9	Explain about intercooling	Understanding	2
10	Explain multistage compression	Understanding	2
11	What is the significance of heat balance sheet? Discuss the procedure to draw heat balance sheet for CI engine?	Understanding	2
12	Define the following terms: Indicated Power, Brake power, Friction Power, Mechanical efficiency, Mean effectiveness.	Understanding	2
13	Explain the working principle of reciprocating compressor with a neat sketch.	Understanding	2
14	Explain the work required for Multi-stage compressor?	Analyzing	4
15	What is the condition for maximum efficiency in multistage compression?	Understanding	2
16	Explain the working principle of rope brake dynamometer?	Understanding	2
17	Describe how the IP of a multi-cylinder engine is measured?	Understanding	2
18	Describe the procedure using for balancing heat? What is Sankey diagram?	Understanding	2
19	Explain the phenomenon of knocking in SI engines? What are the different factors influencing the knocking?	Understanding	2
20	Enumerate the applications of compressed air? How are air compressors classified?	Analyzing	4

PART-C ANALYTICAL QUESTIONS

1	The data recorded during the trial of a two stroke diesel engine are as follows: Engine speed=1500rpm Load on brakes =110kg brake arm=900mmDetermine the following: (a) Brake torque, (b) Power available at the brakes of the engine	Applying	3
2	During testing a two stroke diesel engine with rope brake dynamometer, the following were recorded: Engine speed=700rpm, Diameter of brake drum =600mm; Diameter of rope=50mm; Dead load on the brake drum=35kg; spring balance reading=4.5kg; find the power available at the	Evaluating	5

	brakes in KW.		
3	During the trial on a single cylinder, four stroke, diesel engine the following are noted: Load on hydraulic dynamometer=950N; Dynamometer constant=7500; Fuel used per hour=10.5kg/hr; calorific values of fuel=50000kJ/Kg, Engine speed=400rpm; calculate brake thermal efficiency of the engine?	Evaluating	5
4	An Otto cycle four stroke gas engine has a cylinder 25cm in diameter and the stroke of the piston is 40cm. It operates under the following conditions: Speed=200rpm; misfires per minute=10; mean effective pressure=6.2kg/sq.cm; Mechanical efficiency=80%. Determine (a)IHP (b)BHP and (c)FHP.	Evaluating	5
5	Calculate the volumetric efficiency of a petrol engine of 6cm bore and 9cm stroke if each cylinder sucks 0.0025kg of charge during suction stroke. Assume R as 29.27.	Evaluating	5

UNIT IV COMPRESSORS

PART-A SHORT ANSWER QUESTIONS

S.NO	Questions	Blooms Taxnomy level	course outcome
1	What is volumetric efficiency in case of compressor?	Understanding	2
2	Define slip factor	Understanding	2
3	Define pressure coefficient.	Analyzing	4
4	What is the difference between reciprocating and rotary compressors?	Analyzing	4
5	What is stalling?	Analyzing	4
6	Draw p-v and T-S diagram of a MULTI stage reciprocating compressors?	Analyzing	4
7	What is the function of an intercooler in compressors?	Analyzing	4
8	What are rotary compressors?	Analyzing	4
9	What is the difference between positive displacement and non positive displacement compressors?	Analyzing	4
10	What do you mean by Choking?	Analyzing	4
11	What is the difference between rotary compressor and reciprocating compressor?	Understanding	2
12	Draw the diagram of Roots blower compressor?	Understanding	2
13	Draw the diagram of Vane blower compressor?	Analyzing	4
14	What is the working principle of centrifugal compressor?	Analyzing	4
15	What is the importance of velocity triangle in centrifugal compressor?	Analyzing	4
16	What is the mechanical efficiency of compressor?	Analyzing	4
17	State five uses of compressors?	Analyzing	4
18	On what factors compressors are to be selected?	Analyzing	4
19	What is power input factor in compressor?	Analyzing	4
20	Classify the types of compressors	Understanding	2

PART-B LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxnomy level	course outcome
1	State how the air compressors are classified?	Understanding	2
2	Explain the working of roots blower?	Evaluate	4
3	Explain the working of vane blower and also draw the actual p -v diagram of a compressor?	Evaluating	5
4	What is rotary compressor how are they classified?	Applying	3
5	Draw the velocity diagram of an axial flow compressor?	Evaluating	5
6	What do you mean by multistage compression? And state its advantages?	Applying	3
7	Draw velocity diagrams of centrifugal compressors?	Evaluating	5

8	Compare between reciprocating and rotary compressors?	Understanding	2
9	Compare between axial flow and centrifugal compressors?	Understanding	2
10	Discuss of working centrifugal compressors?	Understanding	2
11	Discuss the merits and demerits of rotary compressor over reciprocating compressor?	Understanding	2
12	List the various types of rotary compressors. Explain with a neat sketch the working of a vane blower.	Evaluating	5
13	Explain the working of an axial flow compressor with a neat sketch?	Evaluating	5
14	How does the working of centrifugal compressor differ from the axial flow compressor?	Applying	3
15	Give the analysis of centrifugal compressor with the help of velocity diagrams?	Evaluating	5
16	State the conditions which lower the volumetric efficiency ?	Evaluating	5
17	Explain with a neat sketch actual pv diagram for a single-stage compressor?	Analyzing	4
18	What is the effect of atmospheric conditions on the output of a compressor?	Understanding	2
19	Draw the velocity diagrams of an axial-flow compressor? Explain the various parameters?	Analyzing	4
20	Explain with a neat sketch the actual pv diagram for a two stage compressor?	Understanding	2

PART-C ANALYTICAL QUESTIONS

1	An air compressor takes in air at 1 bar and 20 °C and compresses it according to law $pV^{1.2} = \text{constant}$. It is then delivered to a receiver at a constant pressure of 10 bar. $R=0.287 \text{ KJ/Kg K}$. Determine : (i) Temperature at the end of compression (ii) Work done and heat transferred during compression per kg of air.	Applying	3
2	A single –stage , double-acting compressor has a free air delivery (FAD) of 14 m ³ /min. measured at 1.013 bar and 150C. The pressure and temperature in the cylinder during induction are 0.95 bar 320 C. The delivery pressure is 7 bar and index of compression and expansion $n=1.3$.The clearance volume is 5 % of the swept volume. Calculate (i) Indicated power required (ii) Volumetric efficiency.	Evaluating	5
3	Air at 103 K Pa and 27 °C is drawn in LP cylinder of a two stage air compressor and is isentropic ally compressed to 700 KPa. The air is then cooled at constant pressure to 37 °C in an intercooler and is then again compressed isentropic ally to 4 MPa in the H.P cylinder, and is then delivered at this pressure Determine the power required to run the compressor if it has to deliver 30 m ³ of air per hour measured at inlet conditions.	Evaluating	5
4	A roots blower compresses 0.08 m ³ of air from 1.0 bar to 1.5 bar per revolution .Calculate the compressor efficiency.	Evaluating	5
5	A centrifugal compressor delivers 16.5 kg/s of air with a total head pressure ratio of 4 :1 .The speed of the compressor is 1500 r.p.m. Inlet total head temperature is 20 °C, slip factor 0.9 Power input factor 1.04 and 80 % isentropic efficiency. Calculate: Overall diameter of the impeller ii. Power input	Evaluating	5

UNIT V REFRIGERATION

PART-A SHORT ANSWER QUESTIONS

S.No	Questions	Blooms Taxonomy level	course outcome
1	Define refrigeration	Understanding	2
2	Define (i) actual COP (ii) Theoretical COP (iii) Relative COP	Understanding	2
3	What is the difference between wet compression and dry compression?	Understanding	2

4	Write short notes on p-h chart.	Understanding	2
5	What is unit of refrigeration	Understanding	2
6	What is the function of capillary tube in vapour compression refrigeration system.	Evaluating	5
7	What are the different components of vapour compression system	Applying	3
8	what is the effect of subcooling	Analyzing	4
9	Effect of superheating	Analyzing	4
10	What is the function of Expansion valve?	Applying	3
11	What are the elements of refrigeration system?	Understanding	2
12	Write the important applications of refrigeration?	Understanding	2
13	List the various refrigeration systems?	Understanding	2
14	What is the standard rating of a Refrigeration machine	Understanding	2
15	Enumerate important refrigeration applications?	Understanding	2
16	What is the wet compression?	Evaluating	5
17	What is dry compression?	Applying	3
18	What is relative COP?	Analyzing	4
19	What is relative COP?	Analyzing	4
20	List the principles of commonly used refrigerants?	Applying	3

PART-B LONG ANSWER QUESTIONS

S.No	Questions	Blooms Taxonomy level	course outcome
1	Describe a simple vapour compression cycle giving clearly its flow diagram	Understanding	2
2	Show the vapour compression cycle on T-S diagram when the vapour is dry saturated ,super heated, and is wet after compression	Understanding	2
3	What are the factors that effect the performance of a vapour compression system and explain .	Understanding	2
4	What are desired properties of refrigerants	Understanding	2
5	Explain with neat sketch the working of a vapour absorption system.	Applying	3
6	Compare between vapour compression and vapour absorption systems	Understanding	2
7	Explain air refrigeration system	Understanding	2
8	Explain reversed carnot cycle on T-S diagram,	Understanding	2
9	What are the different components of vapour compression system and explain with neat sketch	Understanding	2
10	Classify refrigerants.	Understanding	2
11	Draw the basic refrigeration cycle with all components and explain each component in detail?	Understanding	2
12	Derive the COP of a Refrigeration cycle?	Understanding	2
13	What is mechanical refrigeration and explain various types with diagrams ?	Remembering	1
14	Define the following? (i)Refrigeration (ii)Refrigerating system(iii)Refrigerated system.	Remembering	1
15	State elements of refrigeration systems and explain?	Remembering	1
16	Differentiate clearly between open cycle and closed air refrigeration systems?	Remembering	1
17	Define the following? (i) Actual COP (ii) theoretical COP (iii) relative COP.	Remembering	1
18	What are the main characteristic features of an air refrigeration systems.	Remembering	1
19	State merits and demerits of Vapor compression system and air refrigeration systems?	Understanding	2
20	State the functions of the following parts of a simple vapor compression system: (i) compressor (ii) condenser (iii) Expansion Valve (iv) Evaporator	Remembering	1

PART-C ANALYTICAL QUESTIONS

1	An air refrigeration system operates between 1 MPa and 100 K Pa is required to produce a cooling effect of 2000 KJ/min. Temperature of the air leaving the cold chamber is -5 °C and at leaving the cooler is 30 °C. Neglect losses	Evaluating	5
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	and clearance in the compressor and expander determine(i) Mass of air circulated per min (ii) Compressor work ,expander work,cycle work(iii) COP and power in KW required		
2	28 tonnes of ice from and at 0 °C is produced per day in an ammonia refrigerator. The temperature range in the compressor is 25 °C to -15 °C.The vapour is dry and saturated at the end of compression and an expansion valve is used. Assuming a co efficient of performance of 62% of the theoretical, calculate the power required to drive the compressor. take latent heat of ice is 335 KJ/kg.	Evaluating	5
3	In A Simple Vapor Compression Cycle The Piston Displacement Volume For Compressor Is 1.5litres Per Stroke And Its Volumetric Efficiency Is 80%. The Speed of compressor is 1600rpm. Find the power rating of compressor and refrigerating effect.	Evaluating	5
4	Air at 103 K Pa and 27 °C is drawn in LP cylinder of a two stage air compressor and is isentropic ally compressed to 700 KPa. The air is then cooled at constant pressure to 37 °C in an intercooler and is then again compressed isentropic ally to 4 MPa in the H.P cylinder, and is then delivered at this pressure Determine the power required to run the compressor if it has to deliver 30 m ³ of air per hour measured at inlet conditions.	Evaluating	5
5	Ice Is Formed At 0 °Cfrom Water At 20 °C.The Temperature Of The Brine Is -8 °C.Find Out The Kg Of Ice Formed Per Kwh. Assume That The Refrigeration Cycle Used Is Perfect Reversed Carnot Cycle. Take latent heat of ice as 335kJ/kg.	Evaluating	5

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