Code No: 136CC **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2019
IC ENGINES AND GAS TURBINES
(Mechanical Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

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PART - A

(25 Marks)

1.a)	Define mean effective pressure and stoichiometric air-fuel ratio.	[2]
b)	What is the chemical composition of liquefied petroleum gas?	[3]
c)	What are the limits of flammability for gasoline fuels?	[2]
d)	What is the function of a leak-off fuel in the fuel injection holder?	[3]
e)	What do you mean by HCCI engine?	[2]
f)	What is the use of engine testing?	[3]
g)	Define isentropic efficiency.	[2]
h)	List the advantages of gas turbines over reciprocating IC engines.	[3]
i)	What is meant by Athodyds?	[2]
j)	What is the main difference between rocket propulsion and turbojet propulsion	[3]

PART - B

(50 Marks)

2.a) Describe the working principle of the four stroke CI engine. Mention the typical values of valve timings for a four stroke CI engine.
b) Describe the ASTM distillation test procedure for the measurement of relative volatility of fuels. [5+5]

OR

3.a) How are the reciprocating IC engines classified according to their applications? Mention the predominant type of engines used in each case.
b) How are the SI engine fuels rated in terms of octane number? Define the octane number scale and give the reasons for selecting this scale. [5+5]

4.a) Describe the principle of a timed injection system. What are the two methods of fuel injection using timed injection?
b) An IC engine fuel has the following composition by weight: Carbon 85% , hydrogen 10%, oxygen 3% and the rest is nitrogen. Determine the chemically correct air/fuel ratio. If 30% excess air is supplied, find the percentage of dry product of combustion by weight and by volume. [5+5]

OR

5.a) With the help of a simple diagram, describe the combustion chamber with a pre-chamber used for the lean burn engine.

b) A four stroke four-cylinder CI engine develops 100 KW at 3000 rpm. The specific fuel consumption is 0.225 kg/kWh. Determine the mass of the fuel injected by the nozzle per cycle per cylinder, in the combustion chamber. [5+5]

6.a) What do you mean by stratified charge combustion system? What are the important features of a stratified-charge engine?

b) Explain with mathematical expressions, how the heat balance sheet is prepared for IC engines. [5+5]

OR

7.a) A V-6 four stroke SI engine is required to give 190 KW at 4500 rpm. The brake thermal efficiency is 35%. The air/fuel ratio is 12.5:1 and the volumetric efficiency at this speed is 68%. If the stroke/bore ratio is 0.8, determine the engine displacement required and the dimensions of the bore and stroke. The calorific value of the fuel is 44,200 kJ/kg, and the free air conditions are 1.013 bar and 15^0C.

b) Explain briefly the homogeneous charge combustion ignition. Give a brief account for the technology behind the Gasoline Direct Injection (GDI) engine. [5+5]

8.a) Compare reciprocating engines and gas turbine engines and explain why gas turbine engines are more suitable for aviation applications.

b) Why open cycle gas turbines are more in use than closed cycle gas turbines, explain? [5+5]

OR

9.a) Write a note on gas turbine blade materials.

b) Write a note on the development of gas turbines and explain the two basic reasons which hampered the development of gas turbines in the beginning of the century. [5+5]

10.a) Derive an expression for degree of reaction in axial flow gas turbines with the help of velocity triangles.

b) Discuss the combustion process in combustion chamber of a gas turbine engine with the help of a suitable diagram. [5+5]

OR

11. A simple turbine jet unit was tested when stationary and the ambient conditions were 1 bar and 15^0C. The pressure ratio for the compressor was 4:1. A fuel consumption of 0.37 kg/s was obtained for an air flow of 23 kg/s. Calculate the thrust produced if the exhaust gases from the turbine were expanded to atmospheric pressure in a convergent nozzle. Assume the following data

Isentropic efficiency of compressor	80%
Isentropic efficiency of turbine	85%
Efficiency of nozzle	93%
Transmission efficiency	98%
Calorific value of fuel	42000 kJ/kg

Assume working fluid to be air throughout. [10]

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