



JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April-May 2015

B. Tech in Mechanical Engineering, Semester IV

Roll No.....

ME 409: I.C. Engines & Gas Turbines

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Scientific Calculator without programming of any type is allowed.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	The normal range of compression ratio for Diesel cycle is; (a) 4 to 6 (b) 6 to 8 (c) 15 to 20 (d) >25	
ii.	Thermal efficiency of CI engine is higher than that of SI engine due to; (a) fuel used (b) higher compression ratio (c) constant pressure heat addition (d) none of the above	
iii.	Thermal efficiency of CI engine is higher than that of SI engine due to; (a) fuel used (b) higher compression ratio (c) constant pressure heat addition (d) none of the above	
iv.	Volumetric efficiency is a measure of; (a) speed of the engine (b) power of the engine (c) breathing capacity of the engine (d) pressure rise in the cylinder	
v.	The function of a carburetor in SI engine is to control; (a) A/F ratio (b) amount of mixture (c) A/F ratio and amount of mixture (d) compression ratio and volumetric efficiency	
vi.	Radiator is provided to; (a) cool the jacket water (b) pressurize the cooling water (c) provide additional water flow (d) none of the above	
vii.	The lubricating system incorporated in most of the two stroke engine is; (a) wet sump lubrication system (b) Splash system for a single cylinder engine (c) Mist lubrication (d) Dry sump lubrication system	
viii.	Efficiency of Stirling cycle is same as; (a) Otto cycle (b) Diesel cycle (c) Carnot cycle (d) Ericsson cycle	
ix.	Intercooling in gas turbines at an optimum pressure; (a) increases net output (b) increases thermal efficiency (c) both "a" and "b" (d) decreases fuel consumption	
x.	The lubricants commonly used in the automobiles are; (a) animals oils (b) vegetable oils (c) mineral oils (d) cooking oils	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	What is meant by TDC and BDC? In a suitable sketch mark the two dead centres.	
ii.	What is the function of a radiator?	
iii.	Compare the relative advantages and disadvantages of four-stroke and two stroke engines.	
iv.	Discuss the functions of lubricant in an engine.	
Q.3A	What is meant by delay period? It is usually divided into two parts. Name and describe them.	05
Q.3B	A certain engine produces 10 kW indicated power. Its mechanical efficiency is 80 percent. Find the brake power delivered and friction power.	05
Q.4A	Explain the stages of combustion in a Compression Ignition engine.	05
Q.4B	Discuss briefly the various lubricating systems used for I.C. engines.	05



Q.5A	Describe a battery ignition system with the help of a sketch.	05
Q.5B	Explain the stages of combustion in a CI engine.	05
Q.6A	What do you understand by ignition timing? Discuss the various factors which affect ignition timing requirements.	05
Q.6B	Derive an expression for the air standard efficiency of the Otto cycle.	05
OR		
Q.6B	How will you classify the compressors? Differentiate between the working principles of positive displacement and dynamic compressors.	05
Q.7	Enlist and discuss the important properties of a lubricant which affect engine performance.	10
OR		
Q.7	Derive the expressions for efficiency and specific work output for a simple gas turbine cycle in terms of pressure ratio.	10
Q.8	Derive an expression for the mean effective pressure of the Otto cycles.	10
Q.9	A test on a single cylinder, four stroke oil engine having bore 18 cm and stroke 36 cm yielded the following results; speed 285 rev/min; brake torque, 393 Nm; indicated m.e.p., 7.2 bar; fuel consumption, 3.5 kg/hr; cooling water flow, 4.5 kg/min; cooling water temperature rise 36°C; air-fuel ratio by mass, 25; exhaust gas temperature, 415°C; barometric pressure, 1.013 bar, room temperature 21°C. The fuel has a calorific value of 45200 kJ/kg and contains 15% by mass of hydrogen. Determine (a) indicated thermal efficiency (b) the volumetric efficiency based on atmospheric conditions. Draw up a heat balance in terms of kJ/min explaining clearly the content of such term. Take $R = 0.287 \text{ kJ/kg K}$, C_v for dry exhaust gases = 1.005 kJ/kg K and for superheated steam $C_p = 2.05 \text{ kJ/kg K}$.	10
Q.10	An air standard diesel cycle has a compression ratio of 14. The pressure at the beginning of the compression stroke is 1 bar and the temperature is 27°C . The maximum temperature is 2500°C . Determine the thermal efficiency and the mean effective pressure.	10
OR		
Q.10	The air flow to a four cylinder four stroke oil engine is measured by means of a 5 cm diameter orifice, having a coefficient of discharge of 0.7. During a test on the engine the following data were recorded: Bore 12.5 cm; stroke 12.5 cm; engine speed 1200 RPM; brake torque, 150 Nm; fuel consumption 5.5 kg/hr; calorific value of fuel 43100 kJ/hr; head across orifice, 5.7 cm of water; ambient temperature and pressure, 20°C and 1.013 bar respectively. Calculate: 1. The thermal efficiency on b.p. basis. 2. The brake mean effective pressure. 3. The volumetric efficiency based on free air condition.	10

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