

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2019**  
**MECHANICAL ENGINEERING**  
**Specialization: THERMAL ENGINEERING**

03ME6031 IC ENGINE SYSTEMS AND PERFORMANCE ANALYSIS

Max. Marks : 60

Duration: 3 Hrs

**PART – A**  
**(Answer All Questions)**

**(4×5 = 20)**

- I** List 10 engine performance parameters.
- II** Compare between a conventional carburettor system and MPFI system
- III** Write the phenomenon of knock in CI engine?
- IV** Explain the pollutants formed by incomplete combustion of fuels in SI engine.

**PART – B**

**(4×10 = 40)**

- V.A** (i) Show that the efficiency of the diesel cycle is lower than that of Otto cycle for the same compression ratio. **4**
- (ii) A three-litre SI V6 engine operates on a four-stroke cycle at 3600 RPM. The compression ratio is 9.5, the length of the connecting rod is 16.6 cm, and the engine is square (B=S). At this speed, combustion ends at 20° a TDC. Calculate: a) cylinder bore and stroke length, b) average piston speed, c) clearance volume of one cylinder, d) piston speed at the end of combustion, e) distance the piston has travelled from TDC at the end of combustion. **6**

**OR**

- V.B** (i) Explain the importance of air fuel ratio in SI engine? How does it affect engine performance **4**
- (ii) A four-stroke, four-cylinder diesel engine running at 2000 rpm develops 60 kW. Brake thermal efficiency is 30 % and calorific value of fuel is 42 MJ/kg. Engine has a bore of 120 mm and stroke of 100 mm. Take density of air = 1.15 kg/m<sup>3</sup>, air-fuel ratio = 15:1 and mechanical efficiency = 80 %. Calculate a) fuel consumption (kg/s), b) air consumption (m<sup>3</sup>/s), c) indicated thermal efficiency d) Volumetric efficiency, e) brake mean effective pressure, f) mean piston speed. **6**

- VI.A** (i) Explain the working of port injection MPFI system **4**
- (ii) Explain different types of superchargers, with figure **6**

**OR**

- VI.B** (i) Write the factors to be considered while designing combustion chamber of SI engine **5**

- (ii) Explain the two categories of combustion chambers in CI engines. 5
- VII.A** (i) Schematically explain the use of the study of the heat balance of an engine. 3
- (ii) In a trial of single cylinder oil engine working on dual cycle, the following observations were made. Compression ratio-15, Oil consumption – 10.2 kg/h, Calorific value – 43890kJ/kg, Air consumption – 3.8kg/min, speed – 1900rpm, Torque on brake drum – 186 Nm, Quantity of cooling water used-15.5kg/min, temperature rise of cooling water – 36 C, Exhaust gas temperature – 410 C, Room temperature-20 C, Cp for exhaust gases – 1.17 kJ/kg K 7
- Calculate: (a) Brake Power (b) Brake specific fuel consumption (c) Brake thermal efficiency. Draw heat balance sheet on minute basis

**OR**

- VII.B** (i) Explain the effect of various engine variables on SI engine knock 5
- (ii) Explain the stages of combustion in CI engine 5
- VIII.A** (i) Explain the various exhaust emissions from SI engines 5
- (ii) What is a thermal converter? How does it help to reduce emissions from engines? 5

**OR**

- VIII.B** (i) What is EGR? Explain how EGR reduces NO<sub>x</sub> emissions 5
- (ii) Explain the advantages and disadvantages of HCCI engines 5