Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2018

SUBJECT: DESIGN OF IC ENGINES [AAE 4020]

REVISED CREDIT SYSTEM
(26/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Permitted to use design data handbook.

1A. Classify the different types of cylinder heads based on construction. **(02)**

1B. A four-stroke engine working on diesel cycle has the following specifications: Brake specific fuel consumption = 0.2721 kg/kwh, fuel consumption = 1.905 kg/hr, speed = 1400 rpm, Indicated mean effective pressure = 0.35 N/mm^2, maximum gas pressure = 3.5 N/mm^2, mechanical efficiency = 80%, length to diameter ratio of cylinder = 1.5, allowable stress on cylinder = 45 N/mm^2. If the cylinder is made of cast iron, determine the cylinder bore, cylinder length, wall thickness, thickness of cylinder head, longitudinal stress and Hoop stress. **(08)**

2A. Name the parts of piston with its neat sketch. **(03)**

2B. The cast iron piston of single acting four-stroke engine for the following data:- bore = 200 mm, length of the stroke = 250 mm, maximum explosion pressure = 4 N/mm^2, brake mean effective pressure = 0.60 N/mm^2, fuel consumption = 0.25 kg/kwh, speed = 600 rpm, length to diameter ratio of piston pin is 1.5, permissible tensile stress for cast iron piston is 40 N/mm^2, allowable radial pressure on cylinder wall is 0.04 N/mm^2, permissible tensile stress for piston rings is 100 N/mm^2. Calculate crown thick ness, dimensions of ribs and cup, dimensions of piston ring and length of piston skirt. **(07)**

3A. Explain the fixed center design type of Connecting rod. **(02)**

3B. The following data is given for the connecting rod of diesel engine: cylinder bore = 85 mm, length of the connecting rod = 350 mm, maximum gas pressure = 3.5 N/mm^2, factor of safety against buckling = 5, length to diameter ratio for piston pin = 1.5, length to diameter ratio for crank pin = 1.25, allowable bearing pressure for piston pin = 13 N/mm^2, allowable bearing pressure for crank pin = 11 N/mm^2, length of the stroke = 140 mm, mass of the reciprocating parts = 1.5 kg, engine speed = 2000 rpm, thickness of bearing bush = 3 mm, yield strength of big-end bearing cap material = 380 N/mm^2, factor of safety for cap = 4, yield strength of bolt material = 450 N/mm^2, factor of safety for bolts = 5. Calculate dimensions of the cross-section of connecting rod, dimensions of small and big end bearings, nominal diameter of bolts for cap, thickness of big-end bearing cap. **(08)**

4A. List the differences between poppet and sleeve valve. **(02)**

4B. The conical valve of I.C engine is 60 mm in diameter and is subjected to a maximum gas pressure of 4 N/mm^2. the safe stress in bending for the valve material is 46 MPa. length of the stroke = 275 mm, engine speed = 500 rpm, the valve is made of steel which k=0.42. The angle at which the valve disc seat is tapered is 30°. Determine diameter of valve port, thickness of valve head, stem diameter and maximum lift of the valve. **(04)**

4C. Explicate the purpose of cooling and lubrication systems in IC engine. Mention its types. **(04)**

5A. Mention the forces which induce bending and torsional moments on crankshaft. **(02)**

5B. Design a plain carbon steel center crankshaft of single cylinder engine for the following data: cylinder bore = 400 mm, stroke = 600 mm, engine speed = 200 rpm, mean effective pressure = 2.5 N/mm^2, weight of the flywheel used as a pully = 50 kN, total belt pull = 6.5 kN. When the crank has turned through 35° torque on the shaft is maximum when the crank turns through 25° from the TDC and at this position the gas pressure inside the cylinder is 1 N/mm^2. Calculate components of force on crank pin, bearing reaction and dimensions of crank pin when the crank shaft is at an angle of 25°. **(08)**