Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End semester Examination, Dec. 2019

Course Name: Automotive Engine Components Design | **Semester: VII**
Course code: ADEG 431 | **Max. Marks: 100**
Programme: B.Tech / ADE (Automotive Design Engineering) | **Time: 03 hrs.**
Instructions:

- **a) Design data handbook will be provided.**
- **b) Assume suitable value for missing data in any questions.**

S. No.	**SECTION-A** ***(Answer all four questions. All questions carry equal marks)*** **(4x5=20 Marks)**	**Marks**	**CO**
Q 1.	Draw a neat sketch of a piston and mark the component parts	**5**	**CO1**
Q 2.	Name the materials used for crankshaft	**5**	**CO4**
Q 3.	State the method of calculating the mass and cross section of flywheel rim	**5**	**CO5**
Q 4.	Define the following: a) Height of the governor c) Equilibrium speed b) Sleeve lift d) Maximum and minimum equilibrium	**5**	**CO6**
	SECTION-B ***(Attempt all four questions. All questions carry equal marks)*** **(4x10=40 Marks)**		
Q 5.	A four stroke diesel engine has the following specifications; Brake power = 7.5 kW; Speed = 1400 r.p.m.; Mechanical efficiency = 80% Indicated mean effective pressure = 0.35 N/mm^2; Maximum pressure = 3.5 N/mm^2 If the cylinder made of cast iron, determine the cylinder dimensions. Take L/D ratio is 1.5; Allowable stress for CI cylinder as 45 N/mm^2; Allowance for Reboring C= 4 mm; Allowable stress for studs as 50 N/mm^2 Determine the dimensions of the engine cylinder, cylinder head, liner and bolts and studs for a four-stroke internal combustion petrol engine. (Or) The cylinder of a four stroke diesel engine has following specifications: Cylinder bore = 150 mm Brake power = 3 Kw Mechanical efficiency = 80% Indicated Mean effective pressure = 0.3 MPa	**10**	**CO3**

	Maximum gas pressure = 3 MPa Allowable tensile stress = 50 N/mm^2. Determine the thickness of cylinder wall. Also, calculate the apparent and net circumferential and longitudinal stresses in cylinder wall.		
Q 6.	Find the cross section of the connecting rod of a petrol engine, from the following data: Diameter of the piston = 90 mm Length of the connecting rod = 300 mm Maximum explosion pressure = 2.2 N/mm^2 Factor of safety =5 The rod of I section, with width, 4t, and depth, 5t where, 't' is the thickness of web and flanges. Compare the values of t obtained in direct compression and buckling.	**10**	**CO2**
Q 7.	Determine the Piston rings dimensions and length of the skirt based on following data: Cylinder bore = 250 mm; Material for piston rings = Grey cast iron Thickness of piston head = 40 mm Number of piston rings = 4 Allowable tensile stress = 100 N/mm^2 Allowable radial pressure on cylinder wall =0.03 MPa. Maximum gas pressure = 4 MPa.	**10**	**CO1**
Q 8.	A single cylinder I.C.engine working on four stroke cycles develops 75 kW at 360 r.p.m. The maximum fluctuation of energy can be assumed to be 0.9 times the energy developed per cycle. If the total fluctuation of speed is not to exceed 1% and the maximum centrifugal stress in the flywheel is to be 5.5 MN/mm^2. Estimate the mean diameter and area of the flywheel rim. Take ρ=7200 kg/m^3	**10**	**CO5**
SECTION-C ***(Attempt all two questions. All questions carry equal marks)*** **(2x20=40 Marks)**			
Q 9.	Design a plain carbon steel center crankshaft for a single acting four-stroke single cylinder engine. The specifications are: Bore = 100 mm; Stroke = 140 mm; Mean effective pressure = 0.9 MPa Maximum combustion pressure = 2.45 MPa; Weight of the flywheel = 6.80 kN Total belt pull = 5.0 kN; Engine speed = 200 r.p.m.	**20**	**CO4**

	When the crank is at the top dead center, the pressure on the piston is 1.1 N/mm^2; and the torque is maximum. Take l/r = 4.5; the distance between the bearings 1 and 2 is 100 mm and 2 and 3 is 370; Allowable bearing pressure for crank pin = 10MPa; σ_b = 60 N/mm^2 (Or) Design a plain carbon steel center crankshaft for a single acting four stroke single cylinder engines. The specifications are: Bore = 100 mm; Stroke = 140 mm; Mean effective pressure = 0.9 MPa Maximum combustion pressure = 2.45 MPa; Weight of the flywheel = 6.80 kN Total belt pull = 5.0 kN; Engine speed = 200 r.p.m. When the crank has turned 32^o form the top dead center, the pressure on the piston is 1.1 N/mm^2; and the torque is maximum. Take l/r = 4.5; the distance between the bearings 1 and 2 is 100 mm; Allowable bearing pressure for crank pin = 10MPa; σ_b = 60 N/mm^2		
Q 10.	a. Design of an exhaust valve for a horizontal diesel engine using following data: Cylinder bore= 250 mm Length of the stroke = 300 mm Engine speed = 600 rpm Maximum gas pressure = 3.5 MPa Seat angle = 45^o Take: Allowable bending stress for valve = 50 N/mm^2 Calculate: a) Diameter of valve port b) Diameter and thickness of valve head c) Diameter of valve stem d) Maximum lift of valve (10) b. In a governor of the Hartnell type, the mass of each ball is 1.5 kg and the lengths of the vertical and horizontal arms of the bell crank lever are 100 mm and 50 mm respectively. The fulcrum of the bell crank lever is at a distance of 90 mm from the axis of rotation. The maximum and minimum radii of rotation of balls are 120 mm and 80 mm and the corresponding equilibrium speeds are 325 and 300 r.p.m. find the stiffness of the spring and the equilibrium speed when the radius of rotation is 100 mm. (10)	**20**	**CO5 / CO6**