BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

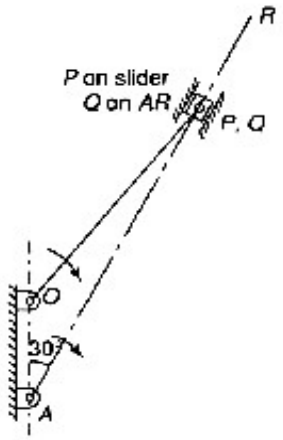
CLASS: BTECH **SEMESTER : IV**
BRANCH: MECH/PIE **SESSION : SP/2025**

SUBJECT: ME207 KINEMATICS AND DYNAMICS OF MACHINE

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. **The question paper contains 5 questions each of 10 marks and total 50 marks.**
2. **Attempt all questions.**
3. **The missing data, if any, may be assumed suitably.**
4. **Before attempting the question paper, be sure that you have got the correct question paper.**
5. **Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

			CO	BL
Q.1(a)	One cylinder of a rotary engine is shown in the figure below. OA is the fixed crank, 200 mm long. OP is the connecting rod and is 520 mm long.	[5]	1	BL-3

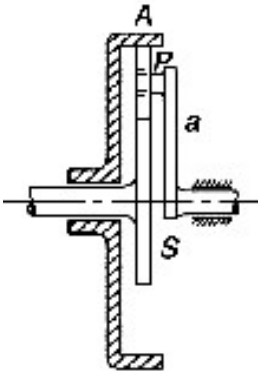


The line of stroke is along AR and is inclined at 30^0 to the vertical. The body of the engine consisting of cylinders rotates at a uniform speed of 400 rpm about the fixed centre. Determine the velocity of piston (slider) inside the cylinder and angular velocity of the connecting rod.

Q.1(b)	In a four-link mechanism, the crank *AB* rotates at 36 rad/s. The lengths of the links are *AB*= 200 mm, *BC*= 400 mm, *CD*= 450 mm and *AD*= 600 mm. *AD* is the fixed link. At the instant when *AB* is at right angles to *AD,* determine the angular velocity of link CD using instantaneous centre method.	[5]	1	BL-3
Q.2(a)	Derive an expression for the rotational speed of a Proell governor.	[5]	2	BL-4
Q.2(b)	The turning-moment diagram for a petrol engine repeats itself after every half revolution of the crankshaft. The areas above and below the mean torque line are 6.5, -14.5, 2, -9.5, 21.75, and -6.25 kN-m. The rotating parts have a mass of 55 kg and radius of gyration of 2.1 m. If the engine speed is I600 rpm, determine the coefficient of fluctuation of speed.	[5]	2	BL-3
Q.3(a)	Find the magnitudes of the unbalanced primary and secondary forces in V-engines. Deduce the expressions when the lines of stroke of the two cylinders are at 60^0 and 90^0 to each other.	[5]	3	BL-3
Q.3(b)	A four crank engine has the two outer cranks set at 120^0 to each other, and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks. If the length of each crank is 300 mm, the length of each connecting rod is 1.2 m and the speed of rotation is 240 RPM, what is the maximum secondary unbalanced force?	[5]	3	BL-3

PTO

Q.4(a)	How are the cams classified? Describe in details.	[5]	4	BL-2
Q.4(b)	In an epicyclic gear, given in the figure, T_S = 40. T_P =20 and T_A = 80. If the sun gear (S) rotates at 150 rpm counter-clockwise and the annular ring (A) clockwise at 400 rpm, find the arm (a) speed.	[5]	4	BL-3



Q.5(a)	Explain in what way the gyroscopic couple affects the motion of an aircraft while taking a turn.	[5]	5	BL-2
Q.5(b)	A disc with radius of gyration of 50 mm and a mass of 5 kg is mounted centrally on a horizontal axle of 80 mm length between the bearings. It spins about the axle at 800 rpm counter-clockwise when viewed from the right-hand side bearing. The axle precesses about a vertical axis at 60 rpm in the anti-clockwise direction when viewed from above. Determine the resultant reaction at each bearing due to the mass and the gyroscopic effect.	[5]	5	BL-3

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