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B.E./B.Tech. DEGREE EXAMINATIONS, April/May 2012
III – Semester, Manufacturing Engineering
Regulations 2004
ME550 – Mechanics of Machines

Duration: 3-Hours

Max. Marks: 100

Answer ALL questions
Part – A (10X2 = 20 marks)

- 1 Name the degrees of freedom possible for a ball and socket joint support.
- 2 Name any two inversions of single slider crank chain.
- 3 What is meant by mechanical advantage of a machine?
- 4 Define the creep of belt.
- 5 Define the following w.r.to gears
 - (i) module
 - (ii) line of action
- 6 What is the purpose of a differential gear of an automobile?
- 7 What are the conditions to be satisfied for static and dynamic balancing of rotating masses?
- 8 Define the term Piston effort and express the same mathematically.
- 9 What is the force exerted by a rotating mass 'm' of radius 'r' rotating with a speed of ω rad/s?
- 10 Differentiate between free and forced vibrations.

Part – B (5 X 16 = 80 marks)

Q11 – Compulsory, from Q12 onwards answer either (a) or (b)

- 11 With line sketch explain the following (16)
 - (i) Simple gear train
 - (ii) Compound gear train
 - (iii) Reverted gear train
 - (iv) Epicyclic gear train
- 12 a) Sketch and explain various inversions of single slider crank chain. (16)

[OR]

- 12 b) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 55° of cam rotation. The valve must remain in the fully open position for 25° of cam rotation. (16)

The lift of the valve is 36.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam.

- 13 a) A single dry plate clutch transmits 7.5 kW at 900 rpm. The axial pressure is limited to 0.07 MPa. If the coefficient of friction is 0.25, find i) mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and ii) outer and inner radii of the clutch plate. (16)

[OR]

- 13 b) An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 m apart and transmits 5 kW from the smaller pulley that rotates at 360 rpm. Coefficient of friction between the belt and pulley is 0.35 and the safe working tension is 12 N per mm width. Determine i) minimum width of the belt ii) initial belt tension, and iii) length of the belt required. (16)

- 14 a) When the crank is 45° from IDC on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 0.5 MPa. The diameter of the cylinder = 0.75 m, stroke = 0.5 m, length of the connecting rod = 1 m. Determine the torque on the crank shaft, if the engine runs at 360 rpm and the mass of the reciprocating parts is 220 kg.

[OR]

- 14 b) An internal combustion engine runs at 1800 rpm. The length of connecting rod is 32 cm and crank radius is 8 cm. Determine at 30 % of the outstroke
- (i) the angular position of the crank
 - (ii) the angular velocity of the connecting rod
 - (iii) the linear acceleration of the piston
 - (iv) the angular acceleration of the connecting rod

- 15 a) A shaft carries four masses A, B, C and D of magnitude 300 kg, 250 kg, 400 kg and 200 kg respectively and all the masses revolving at the same radius of 70 mm in the planes measured from A at 250 mm, 400 mm and 750 mm. The angles between the cranks measured anticlockwise are A to B 30° , B to C 70° and C to D 120° . The balancing masses are to be placed in planes P and Q. The distance between planes A and P is 100 mm, between P and Q is 400 mm and between Q and D is 250 mm. If the balancing masses revolve at a radius of 70 mm, find their magnitudes and angular positions (16)

[OR]

- 15 b) A vertical shaft 100 mm in diameter and 1 m in length has its upper end fixed. At the other end it carries a disc of weight 5000 N. The modulus of elasticity of the material is 200 GPa. Neglecting the weight of the shaft, determine the frequency of longitudinal vibrations and transverse vibrations. (16)