

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER 2013****Subject Code: 152504****Date: 20-05-2013****Subject Name: Dynamics of Machines and Production Engineering Drawing****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use answer book for analytical and drawing sheet for graphical solutions and Production Engg. Drawing's answers. [Follow first angle projection method]

- Q.1** (a) (i) State and explain D'Alembert's principle. **03**
(ii) What is meant by Equivalent offset inertia force? Explain. **04**
(b) The following data refer to a horizontal engine: **07**
Mass of reciprocating parts = 250 kg, Difference between the driving and back pressures when crank shaft has traveled 60° from the IDC = 0.35 MPa, Length of crank = 300 mm, Length of connecting rod = 1200 mm, Diameter of cylinder = 500 mm, Speed of engine = 250 rpm
For the given position of crank, neglecting difference of area on two sides of the piston, determine: (i) Piston effort (ii) Reaction at guide bar or slider (iii) Thrust in the connecting rod (iv) Turning moment or crank effort
- Q.2** (a) The crank and connecting rod of an engine are 125 mm and 500 mm respectively. The mass of the connecting rod is 60 kg and its center of gravity (c.g.) is 275 mm from the crosshead pin center, the radius of gyration about center of gravity being 150 mm. **07**
If the engine speed is 600 rpm, for a crank position of 45° from the IDC, using Klein's construction method, find: (i) the acceleration of the piston (ii) the magnitude, position and direction of inertia force due to the mass of connecting rod.
(b) Determine equation for maximum fluctuation of energy for a multi-cylinder engine with the help of its turning moment diagram. Also, define the term Coefficient of fluctuation of speed giving its equation. **07**
- OR**
- (b) Following notations are given for a rigid body: **07**
 m = mass of the body, k_G = radius of gyration about its c.g., G , m_1 and m_2 = two masses which form a dynamically equivalent system, L_1 = distance of mass m_1 from G , L_2 = distance of mass m_2 from G , and L = total distance between the masses m_1 and m_2 . Prove that for a dynamically equivalent system: $(k_G)^2 = L_1 L_2$.
- Q.3** (a) Explain the Method of Direct and Reverse Crank used for balancing of radial engines. **07**

- (b) A rotating shaft carries four masses A, B, C and D rigidly attached to it. The mass centers of these masses are 30 mm, 40 mm, 35 mm and 36 mm respectively from the axis of rotation. The masses A, C and D are 8 kg, 5 kg and 4.5 kg respectively. The axial distance between A and B is 450 mm, between B and C is 500 mm and between C and D is ∞ mm. The angular spacing between the mass A and C is 90° . The magnitude of mass B is not known. For complete dynamic balance, find: (i) Angular spacing between A, B and D. (ii) Axial distance ∞ between planes C and D. 07

OR

- Q.3 (a) What is Field Balancing? Explain field balancing of thin disc using Four Observation Method for it. 07
- (b) In a 4-cylinder inline two stroke I.C. engine, the masses of reciprocating parts per cylinder are 2 kg. The stroke is 120 mm, the length of the connecting rod is 220 mm and the cylinders are spaced at 120 mm pitch. If the cylinders are numbered from 1 to 4 from one end, then in the end view the cranks appear at successive intervals of 90° in the order 1-4-2-3. Find with reference to central plane of the engine, the maximum value of any primary and secondary out of balance effect when the engine runs at 2500 rpm. Solve the numerical by analytical method only. 07

- Q.4 (a) A vibrating system consists of a mass of 75 kg and a spring of stiffness 45 kN/m, and a damper. The damping provides only 25% of its critical value. Find: (i) Damping factor (ii) Critical damping coefficient (iii) Logarithmic decrement (iv) Ratio of two successive oscillations (v) Natural frequency of damped vibrations. 07
- (b) Draw neat sketches of (i) Levis foundation bolt (ii) Cotter foundation bolt. 07

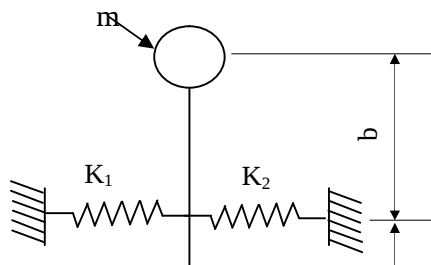
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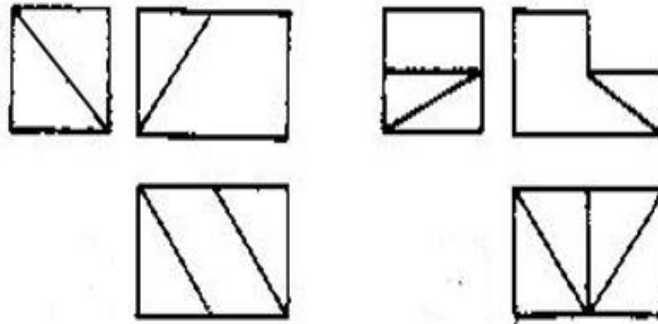
- Q.4 (a) Derive the equation of natural frequency of the system shown in Fig. 1. Also calculate the frequency of vibration neglecting mass of the springs and using following data:
 $k_1 = 12 \text{ kN/m}$, $k_2 = 24 \text{ kN/m}$, $a = 175 \text{ mm}$, $b = 425 \text{ mm}$, $m = 30 \text{ kg}$. 07
- Q.4 (b) Classify assembly drawings according to their uses and briefly explain each of them. 07

- Q.5 (a) Derive the equation for deflection δ of a shaft due to centrifugal force with a single rotor mounted on it. Also define critical speed of a shaft. 07
- (b) A vertical cylinder of 80 mm diameter is completely penetrated by another cylinder of 60 mm diameter, their axes bisecting each other at right angles. Draw their projections showing curves of penetration, assuming the axes of the penetrating cylinder to be parallel to the V.P. 07

OR

- Q.5 (a) (i) Draw missing line/s, full or dotted, in the orthographic views of the objects, shown in Figures 2 (a) and (b) and indicate them by the letters M. L. Support your answer by freehand sketches of the isometric views of the objects, without which, no credit will be given for the answer. 04
- (ii) Draw sketches showing methods of preventing rotation of bolt. 03
- (b) Figure 3 shows two views of an object. Draw Sectional front view and top view and side view of the object. 07





(a) (b)
Fig. 2 [Q-5(a)(i)]

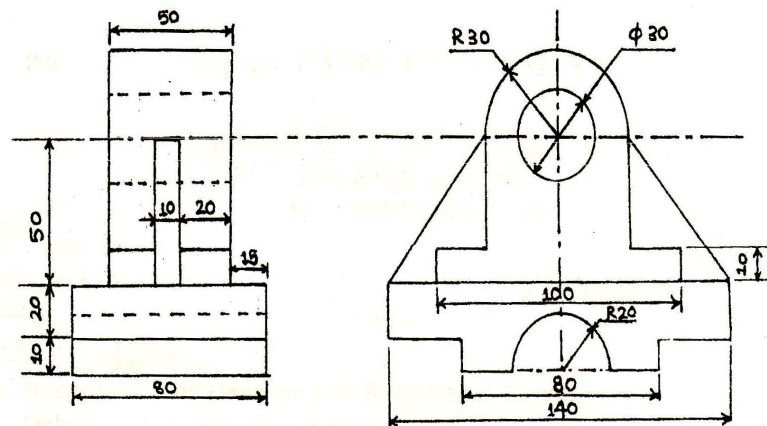


Fig. 3 [Q-5(b)]