SUBJECT CODE NO: E-37
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E.(Mech/Prod) Examination Nov/Dec 2017
Theory of Machines-I
(OLD)

[Time: Four Hours]   [Max.Marks:80]

Please check whether you have got the right question paper.

N.B
    i) <u>Q.1 & Q.6 are compulsory</u>.
    ii) Attempt <u>any two</u> questions <u>from Remaining from each section</u>.
   iii) Assume suitable data, if required.
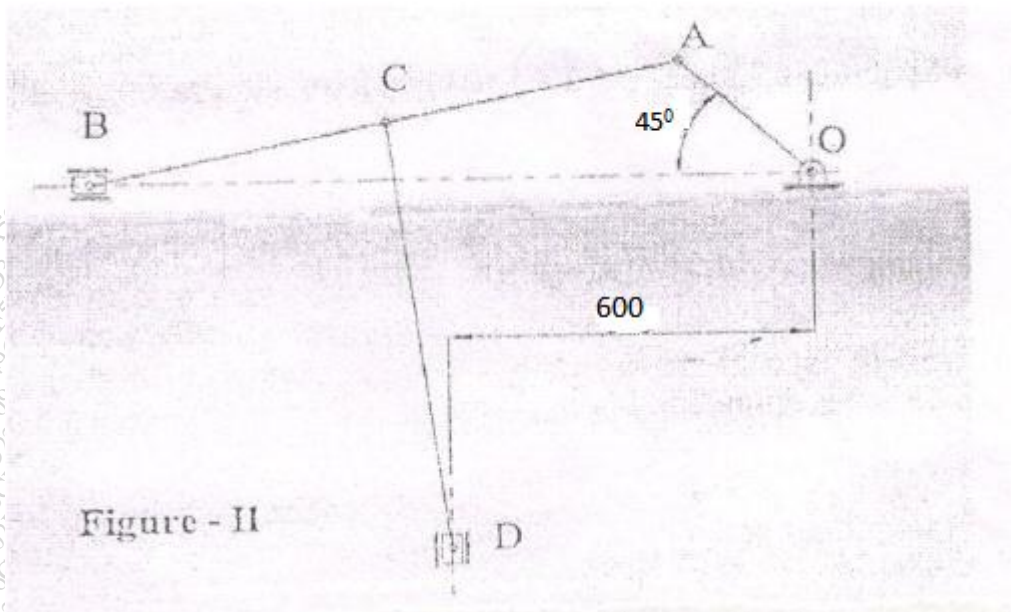
Section A

Q.1 **Attempt <u>any five</u> questions.**   10

    i)   What is kinematics & dynamics?
    ii)   Define higher pair with one example.
    iii)   What is successfully constrained motion?
    iv)   Calculate degree of freedom for four bar mechanism with all turning pairs?
    v)   State Grashof's law for four bar mechanism.
    vi)   State the Kennedy's Theorem of three instantaneous centres.
    vii)   Sketch whitworth's quick return mechanism.
    viii)   What is velocity image?
    ix)   What is velocity of rubbing?
    x)   What is acceleration image?

Q.2 The Mechanism of stone crusher is shown in figure 1. The length of various links in mm are – 15
  OA = 100, AB = 600, BC = 200, AC = 600, QB = 350 CD = 320, MD = 390, OK = 170, MK = 280.
  The cranks rotates at uniform velocity of 120rpm and is inclined at 30° to the horizontal. Draw
 velocity diagram & find
    i)   Velocity of point K (Jaw)
    ii)   Angular velocity of links ABC & MKD
   iii)   Torque required at the Crank OA to overcome a horizontal force of 40KN at K.

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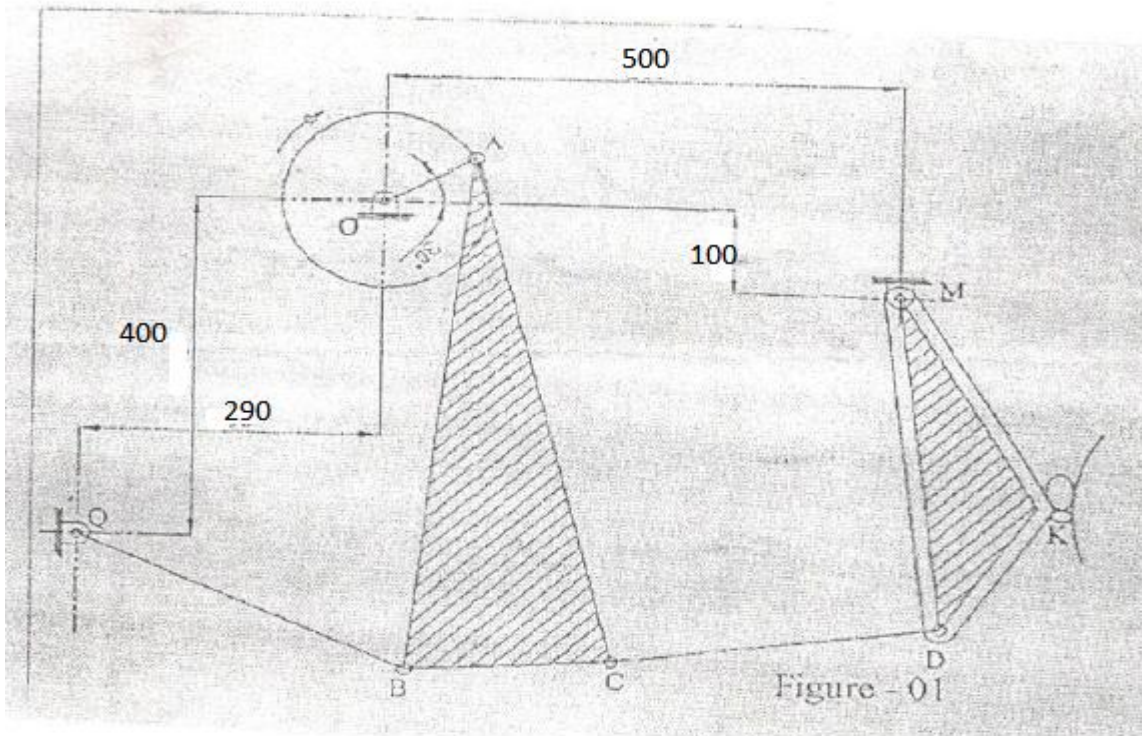
Figure - 01

Q.3   The length of various links of mechanism, as shown in figure 2 are : OA = 300mm, AB=1000mm,   15
      CD = 800 mm, and AC = CB Determine, for the given configuration, the velocity of the Slider D if
      the crank OA rotates at 60 rpm in the clockwise direction. Also find the angular velocity of the link
      CD. Use instantaneous centre method.

Figure - II

Q.4   In a quick return mechanism as shown in figure 3, the driving crank OA is 60 mm long and rotates at   15
       a uniform speed of 200 rpm. In a clockwise direction. For the position shown
       Find – 1. Velocity of Ram R
               2. Acceleration of ram R
               3. acceleration of the sliding block A along the slotted bar CD

120

OA makes 60^0 with vertical
CD=300
RD=300

160

A on slider B on CD

C

Figure-III
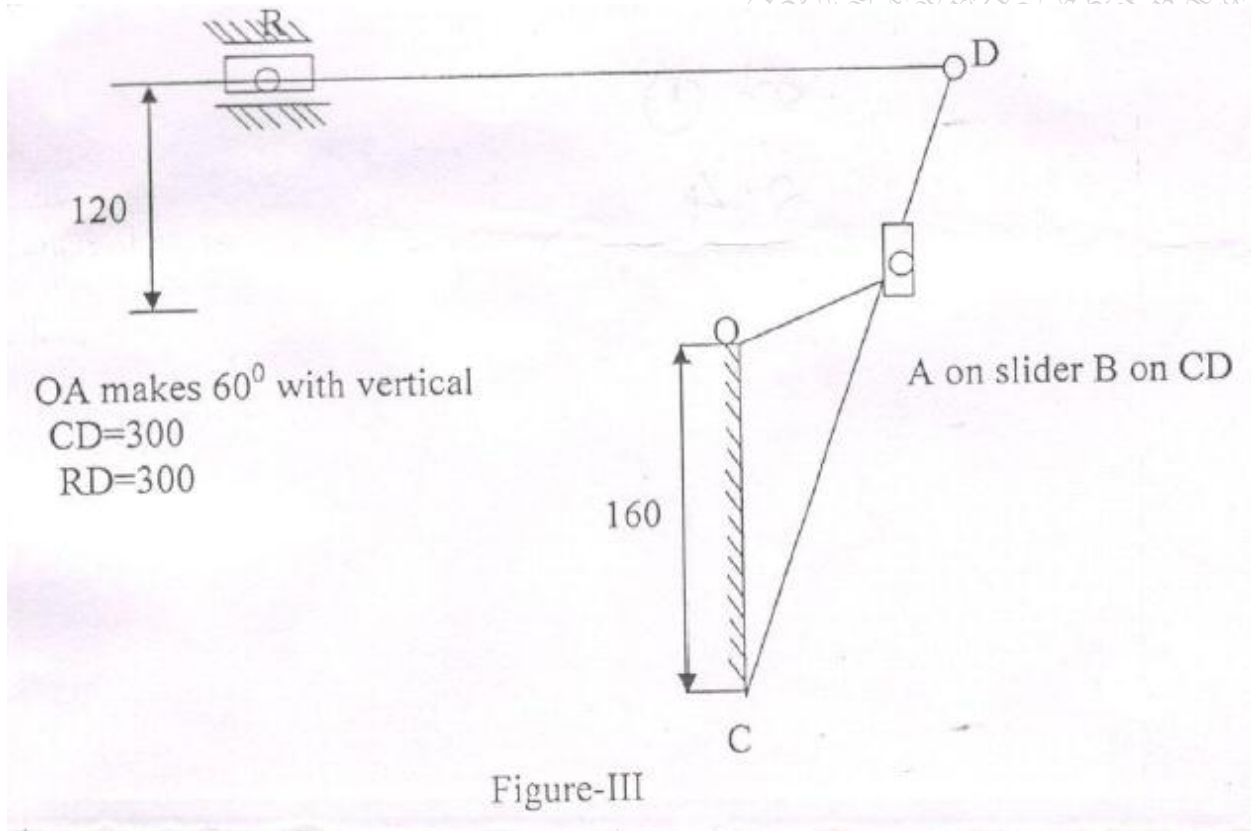
Q.5   a) A mechanism as shown in figure 4, length of various links are; OA = 40mm, AB = 85 mm,   08
           OQ = 100mm, BQ = 70mm. The link OA rotates with 300 rpm clockwise. The link OQ is
           fixed using modified Klein's construction method,
           Find –
                   i)   Velocity of point B
                   ii)   Angular velocity of AB
                   iii)   Acceleration of point B
                   iv)   Angular acceleration of link AB

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Figure - 04
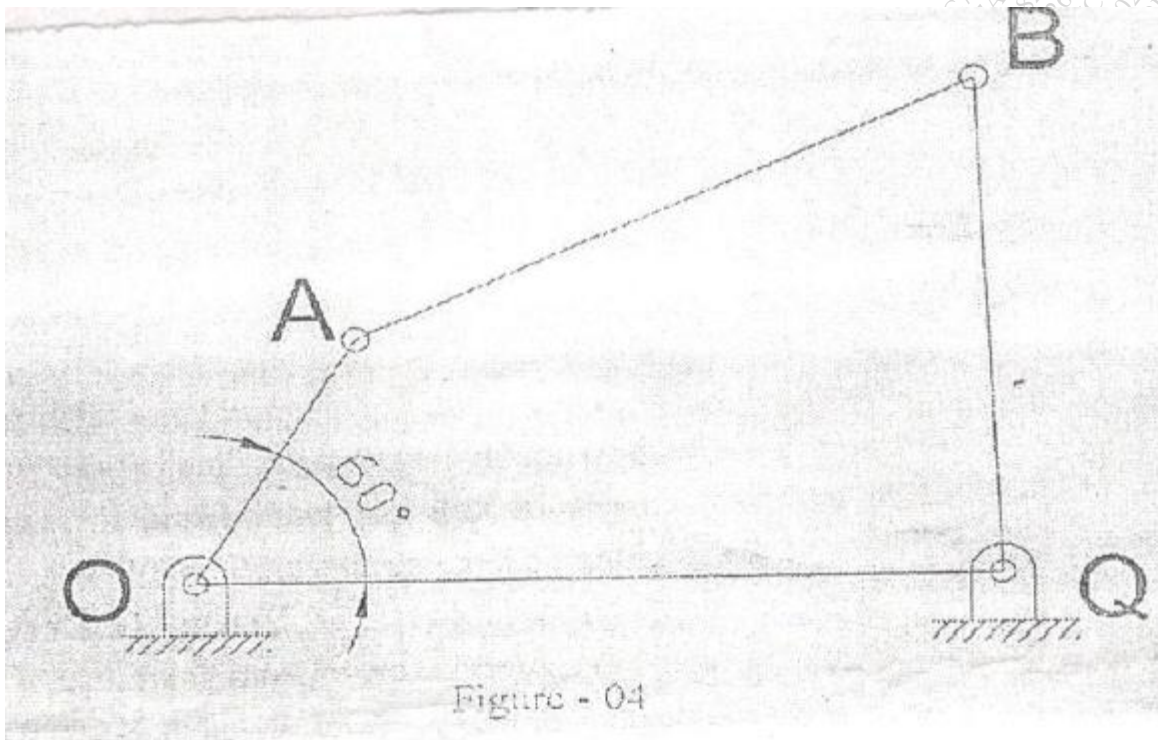
b) How are velocity and acceleration of slider of a single crank chain determined analytically? 07

Section B

Q.6 **Attempt any five questions.** 10

i) Sketch and label a cam profile.
ii) Why radial follower is preferred to that of knife edge follower.
iii) What is displacement diagram in cam?
iv) Distinguish between brakes & dynamometers.
v) Enumerate the types of brakes.
vi) Draw neat sketch of internal expanding brake & labeled it.
vii) Sketch & label epicyclic - train dynamometer.
viii) Explain concept of balancing.
ix) What do you mean by primary unbalancing?
x) What is meant by static & dynamic unbalance?

Q.7 It is required to draw the profile of a cam to give following motion to the follower. 15

i) Follower to move outwards through 31.4mm during 180° of cam rotation with cycloidal motion.
ii) Follower to return with cycloidal motion during 180° of cam rotation.

Determine the maximum velocity and acceleration of the follower during the outstroke when the cam rotates at the 3000 rpm clockwise. The base circle of the cam is of 30mm radius & follower roller radius is 10mm. The axis of the follower is offset by 7.5mm to right.

2017

Q.8   A band and block brake having 12 blocks, each of which subtends an angle of 16° at the centre; is   15
       applied to a rotating drum with a diameter of 600mm. The blocks are 75mm thick. The drum and the
       flywheel mounted on the same shaft have a mass of 1800kg & have a combined radius of gyration of
       600mm. The two ends of band are attached to pins on the opposite sides of the brake fulcrum at
       distance of 40mm & 150mm from it. If a force of 250N is applied on the lever at a distance of
       900mm from the fulcrum find –
                 i)   Maximum braking torque
                 ii)   Angular retardation of the down
                 iii)   Time taken by the system to be stationery from the rated speed of 300rpm.

Q.9   A, B, C, D are the four masses carried by a rotating shaft at 100mm, 150mm, 150mm & 200mm   15
       radius respectively. The planes in which the masses rotate are spaced at 500mm apart and the
       magnitudes of the masses B, C and D are 9 kg, 5 kg, and 4 kg respectively. Find the required mass A
       and the relative angular setting of four masses so that shaft be in complete balance.

Q.10   Each crank and the connecting rod of a four crank in – line engine are 200mm & 800mm   15
       respectively. The outer crank are set at 120° to each other and each has a reciprocating mass of
       200kg. The spacing between adjacent planes of cranks are 400mm 600mm & 500mm. If the engine is
       in complete primary balance, Determine the reciprocating masses of the inner cranks and their
       relative angular positions. Also find the secondary unbalanced force if the engine speed is 210rpm.

2017