1128
## B.E. (Mechanical Engineering)
### Third Semester
### MEC-303: Theory of Machines – I

Time allowed: 3 Hours                                                           Max. Marks: 50

NOTE: Attempt _five_ questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

Q1a)Differentiate between machine and structure.
b)Define transmission angle.
c)Define coefficient of fluctuation of energy.
d)Sketch loose and fast pulleys.
e)Define sensitivity of a governor.                                                    (10)

## Part-A

Q2a)Sketch and explain the inversions of double slider crank chain.                          (5)
b)Locate all the instantaneous centres of slider crank mechanism if the length of crank OB and connecting rod AB are 100 mm and 400 mm respectively and the crank rotates clockwise with an angular velocity of 10 rad/s. Also find: A)Velocity of slider A and
B)Angular velocity of connecting rod AB.                                               (5)

Q3a)Write Freudenstein's equation.                                                       (2)
b)Determine the lengths of all the four links in a four bar chain for the length of the smallest being 10 cm to generate $y=\log_{10} x$ in the interval $1 \leq x \leq 10$ for three accuracy points. The range of the angles of input link and output link are :
$45° \leq \theta \leq 105°$ and $135° \leq \Phi \leq 225°$.                                       (8)

Q4a)A multicylinder engine is to run at a speed of 600 rpm. On drawing the turning moment diagram to a scale of 1mm=250 N-m and 1mm=3°,the areas above and below the mean torque line in mm² are :+160,-172,+168,-191,+197,-162
The speed is to be kept within ± 1% of the mean speed of the engine. Calculate the necessary moment of inertia of the flywheel. Determine the suitable dimensions of a rectangular flywheel rim if the breadth is twice the thickness. The density of the cast iron is 7250 kg/m³ and its hoop stress is 6MPa.Assume that the rim contributes 92% of the flywheel effect.                                                                (6)
b)Explain the procedure of static force analysis of quick return mechanism                   (4)

## Part-B

Q5a)Derive the relation for efficiency of an inclined plane for the motion of body up the inclined plane                                                                           (5)
b)A screw jack has a square thread of mean diameter 6 cm and pitch 0.8 cm .The coefficient of friction at screw threads is 0.09.A load of 3kN is to be lifted through 12 cm .Determine the torque required and the work done in lifting the load through 12 cm .Find also the efficiency of screw jack.                                                             (5)

Q.6a) Derive the relation for length of belt in cross belt drive. (5)

b) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 rpm. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1Mg/m$^3$ and the thickness of belt 10mm, determine the width of the belt taking centrifugal tension into account. (5)

Q.7a) Sketch and explain the working of Prony brake dynamometer. (5)

b) For a spring controlled Hartnell governor :
Mass of governor ball=1.80 kg, length of vertical arm of bell crank lever =8.75 cm, length of other arm of bell crank lever =10.0 cm. The speeds corresponding to radii of rotation of 12 cm and 13 cm are 296 r.p.m and 304 r.p.m respectively. Find the stiffness of spring neglecting the obliquity effect of arms. (5)

x- x- x