ANNUAL EXAMINATION 2020

(Only for Regular Students)

Centre No. 135	***Centre Name- Disha College, Raipur (C.G.)***
Class-B.Sc.-II	**Subject- Mathematics**
Paper No- III	**Paper Name- Mechanics**
Time- 3 hrs.	**M.M.-50**

Note-Solve any two from each unit. All question carry equal marks.

Unit-I

Q1. **,d lf/kr prHkqt dk foijhr Hkqtkvksa dk e/; fcUnqvksa dks yEckbZ l vkSj l' dh gYdh NM+ksa ls lac) fd;k x;k gSA ;fn bu NM+ksa esa ruko** T **vkSj** T' **gks rks fl) dhft, fd**

$$\frac{T}{l} + \frac{T'}{l'} = 0$$

The middle points of opposite sides of a jointed quadrilateral are connected by light rods of length l and l'. If T and T' be the tensions in these rods, prove that-

$$\frac{T}{l} + \frac{T'}{l'} = 0$$

Q2. **lkekU; dSVujh dk dkrhZ; lehdj.k Kkr dhft,A**

Find the Cartesian equation of the common catenary.

Q3. 3P, 7P **rFkk** 5P **cy Øe'k% ,d leckgq f=Hkqt** ABC **dh rhu Hkqtkvksa** AB, BC **rFkk** CA **dh vuqfn'k fØ;k djrs gSA budk ifj.kkeh dk ifjek.k] fn'kk ,oa fØ;kjs[kk dk lehdj.k Kkr dhft,A**

Forces equal to 3P, 7P, 5P act along the sides AB, BC and CA of an equilateral triangle ABC. Find the magnitude, direction and line of action of the resultant .

Unit-II

Q1. **nks cy ,d js[kk** $y = 0, z = 0$ **dh vuqfn'k rFkk nwljh js[kk** $x = 0, z = c$ **dh vuqfn'k yxrk gSA pkfd cy cny jgs gS] rks n'kkZb, fd budk leryh; ejksM+ dh v{k }kjk tfur i"B** $(x^2 + y^2) z = cy^2$ **gSA**

Two forces act, one along the line $y = 0, z = 0$ and the other along the line $x = 0, z = c$. As the forces very, show that the surface generated by the central axis is $(x^2 + y^2) z = cy^2$

Q2. **lery** $lx + my + nz = 1$ **dk 'kwU; fo{ksi fcUnq Kkr dhft,A**

Find the null point of the plane $lx + my + nz = 1$

Q3. **fdlh fn;s x;s cy&fudk; ds dsUnzh; v{k dk lehdj.k Kkr dhft,A**

Find the equation of the central axis of any given system of forces.

Unit-III

Q1. **,d d.k ,d ljy js[kk esa ljy vkorZ xfr ls xfreku gS tc ;g ,d foJkekoLFkk esa xfreku jgrk gSA rc mlds iFk esa e/; fcUnq ls rhu Øekxr lsd.M esa blds pfyr nwfj;k¡ Øe'k%** x_1, x_2, x_3 **gSA fl) dhft, fd blds vkorZdky** $2\pi / \cos^{-1}\left(\frac{x_1+x_3}{2x_2}\right)$ **gSA**

A particle is moving with S.H.M. and while making an excussion from position of rest to the other its distances from the middle point of its path at three consecutive seconds are x_1, x_2, x_3. Prove that the time of a complete revolution is:

$$2\pi / \cos^{-1}\left(\frac{x_1 + x_3}{2x_2}\right)$$

Q2. **/kzqo dh vksj fn"V og cy Kkr dhft, ftlds vUrxZr oØ** $r^n = a^n\, cosn\theta$ **fufeZr fd;k tk ldsA**

Find the force directed towards the pole under which the curve $r^n = a^n\, cosn\theta$ can be described.

Q3. **;fn ç{ksI; iFk dh fdlh ukfHkxr thok ds fljksa ij osx** v_1 **rFkk** v_2 **gksa rFkk** u **osx dk {kSfrt ?kVd gks rks fl) dhft, fd** $\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{u^2}$

If v_1 and v_2 be the velocities at the ends of a focal chord of a projectiles path and u, the horizontal component of velocity, then show that. $\frac{1}{v_1^2} + \frac{1}{v_2^2} = \frac{1}{u^2}$

Unit-IV

Q1. **lw;Z dh ifjØek djus okys fdlh xzg dk egRre rFkk U;wure osx Øe'k% 30 vkSj 29-2 fdeh çfr lsd.M gSA mldh d{kk dh mRdsUnzrk Kkr dhft,A**

The greatest and least velocities of a certain planet in its orbit round the sun are 30 and 29.2 km per second respectively. Find the eccentricity of its orbit.

Q2. **,d d.k ,d lery oØ cukrk gSA ;fn Li'kZ.kh; xfrdky eas Li'kZ js[kh; rFkk vfHkyEc js[kh; Roj.k çR;sd vpj gks] rks fl) dhft, fd le; t esa xfr dh fn'kk dk dks.k** φ **fuEufyf[kr lEcU/k }kjk fn;k tkrk gSA**

$$\varphi = A \log(1 + Bt)$$

A particle is describing a plane curve. If the tangential and normal acceleration are each constant throughout the motion, prove that angle φ which the direction of motion turns in time t is given by:

$$\varphi = A \log(1 + Bt)$$

where A, B are constants.

Q3. **,d #{k pØt dk vk/kkj {kSfrt gS vkSj 'kh"kZ uhps gSA ,d d.k dLi ls foJke voLFkk ls çkjEHk dj uhps 'kh"kZ ij vkdj ;fn foJke voLFkk çkIr djrk gS rks fn[kkb;s fd** $\mu^2 e^{\mu\pi} = 1$

The base of a rough cycloidal arc is horizontal and its vertex downowrd. A bead slides along it starting from rest at the cusp and coming to rest at the vertex. Show that $\mu^2 e^{\mu\pi} = 1$ where μ is the coefficient of friction.

Unit-V

Q1. **xksyh; /kqzoh; funsZ'kkadks ds inksa esa fdlh d.k dk Roj.k Kkr dhft,A**

Find the acceleration of a particle in terms of polar coordinates. (Spherical co-ordinates)

Q2. **,d xksykdkj cwan ok"i esa fxjrs gq, l?kuu }kjk c dh vpj nj ls nzO;eku çkIr djrh gSA n'kkb;s, fd fojke esa fxjrs gq, t le; cwan bldk osx** $\frac{1}{2}gt\left[1 + \frac{M}{M+ct}\right]$ **gS] tgka** M **cwan dk çkjfEHkd nzO;eku gSA**

A spherical drop of liquid falling freely in a vapour acqures mass by condensation at a constant rate c. Show that the velocity after falling from rest in time is $\frac{1}{2}gt\left[1 + \frac{M}{M+ct}\right]$

where M is the initial mass of the drop.

Q3. **,d d.k** V **osx ls ,d fpduh {kSfrt lery ij ,sls ek/;e esa ç{kfir fd;k tkrk gS] ftldh çfr bdkbZ lgfr ij çfrjks/k** K **gSA n'kkb;s, fd** t **le; ds i'pkr d.k dk osx** v **vkSj bl le; esa pyh xbZ nwjh** s **fuEukfdr ls nh tkrh gSA** $v = Ve^{-kt}$ and $s = \frac{V}{k}(1 - e^{-kt})$

A particle is projected with velocity V along a smooth horizontal plane in a resisting medium resistance per unit mass is K. Show that the velocity v after a time t and the distance travelled s in that time are given by: $v = Ve^{-kt}$ and $s = \frac{V}{k}(1 - e^{-kt})$

---000---