Roll No.....

41254

B. Sc. (Hons.) Maths 4th Semester Examination – May, 2019

HYDROSTATIES

Paper : BHM-244

Time : Three hours] ***[Maximum Marks : 60***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting at least ***one*** question from each Section. Question No. **9** is ***compulsory***.

UNIT – I

1. (a) A closed tube in the form of an ellepse with its major axis vertical is filled with three different liquids of densities P_1, P_2, P_3 respectively. If the distances of the surfaces of separation from either focus be r_1, r_2, r_3 respectively, prove that :

$$r_1(P_2 - P_3) + r_2(P_3 - P_1) + r_3(P_1 - P_2) = 0$$

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(b) A mass of fluid is at rest under the forces $x=(y+z)^2-x^2, y=(z+x)^2-y^2, z=(x+y)^2-z^2$, find density and prove that the surfaces of equal pressure are hyperboloids of revolution.

2. (a) A closed tube in the form of an equilateral triangle contains equal volumes of three liquids which do not mix and is placed with its lowest side horizontal. Prove the if the densities of the liquids are in A. P., their surfaces of separation will be at points of trisection of the sides of triangle.

(b) An open vessel containing liquid is made to revolve about a vertical axis with uniform angular velocity. Find the form of the vessel and its dimension that it may be just emptied.

UNIT – II

3. (a) An ellepse is completely immersed with its minor axis horizontal and at a depth h; find the position of centre of pressure.

(b) A hemispherical bowel is filled with water, and two vertical planes are drawn through its central

(f) A gas tank holds 2785 L propane C_3H_8 mm Hg,. What is the volume of the pro the propane at standard pressure ?

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reading C of the faulty barometer is $\frac{(\alpha-a)(\beta-b)(a-b)}{(a-c)(\alpha-a)-(b-c)(\beta-b)}$.

UNIT – V

(a) Define specific Heat.

(b) State Charle's law.

(c) The specific gravities of gold and copper are 19.3 and 8.62 respectively. These metals are mixed to form an alloy. Find the specific gravity of the alloy when gold and copper are mixed in the ratio 11.1 by volume.

(d) Find centre of pressure of a parallelogram immersed in a homogeneous liquid with one side in the surface.

(e) What fraction of the volume of the body will remain immersed if the density of the liquid is three times the mean density of the body ?

radius, cutting off a semi- lune of the surface; if 2a be the angle between the planes, prove that the angle which the resultant pressure on the surface makes with the vertical :

$$= \tan^{-1}\left(\frac{\sin\alpha}{\alpha}\right)$$

4. (a) A cone of given weight and volume, floats with its axis vertical and vertex downwards, prove that the surface of the cone in contact with liquid is least when its vertical angle is $2\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$.

(b) Find the surface of buoyancy and surface of floatation for a cylinder of any section floating in a liquid with one end immersed.

UNIT – III

5. (a) If the floating solid be a cylinder, with its axis vertical and the ratio of specific gravity to that of liquid is σ, prove that the equilibrium will be stable, if the ratio of the radius of the base to the height be greater than $\sqrt{2\sigma(1-\sigma)}$.

(b) A square Lamena is just Immersed vertically in water and is then lowered through a depth h; if a is the length of the edge of the square, prove that the distance of the centre of pressure from the centre of square is $\frac{a^2}{6a+2h}$.

6. (a) A solid body consists of a right cone joined to a hemisphere on the same base and floats with the spherical portion partly immersed in a liquid, prove that the greatest height of the cone consistent with stability is $\sqrt{3}$ times the radius of the base.

(b) A solid cylinder of radius a, length h, specific gravity σ floats in equilibrium of specific gravity P with its axis vertical. Determine the conduction of equilibrium.

UNIT – IV

7. (a) If $v_1, v_2, v_3, \ldots\ldots, v_n$ be the volume of a number of gases at pressures $p_1, p_2, \ldots\ldots p_n$ and absolute

temperatures $T_1, T_2, T_3, \ldots\ldots T_n$ be mixed toge

such that $V_1 P_1 T$ are the volume pressure absolute temperatures of the mixture,

$$\frac{PV}{T} = \frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_2} + \ldots. + \frac{p_nv_n}{T_n}.$$

(b) A piston without weight fits into a ver cylinder closed at its base and filled w atmospheric air, and is initially at the top of cylinder, water being poured slowly on the top the piston; find how much water can be poured before it will run over.

8. (a) If the pressure of air varies as $\left(1+\frac{1}{m}\right)$th power density, show that, neglecting variation temperature and gravity, the height of atmosphere would be equal to (m + 1) times height of the homogeneous atmosphere.

(b) The readings of a perfect mercurial barometer a α and β, while the corresponding readings of faulty one, in which there is some air, are a and prove that the correction to be applied to a