

# Aliah University

Department of Electrical Engineering, B-Tech  
Odd(Autumn) Semester Examination, 2022 (Reg./Supple)  
Subject: Basic Electrical Engineering [EENUGES01]

Full Marks: 80  
Year: I

Time: 3 Hours  
Semester: I

## Answer any five questions

5x16=80 Marks

1. a) Define i) power factor ii) phase sequence iii) power iv) network related to electrical systems. **4 Marks**
- b) State Norton's Theorem. Apply this theorem to calculate current through  $50\Omega$  resistance of the circuit shown in **Fig. 1** **6 Marks**
- c) For the circuit shown in **Fig. 2** find three loop current using mesh analysis. **6 Marks**

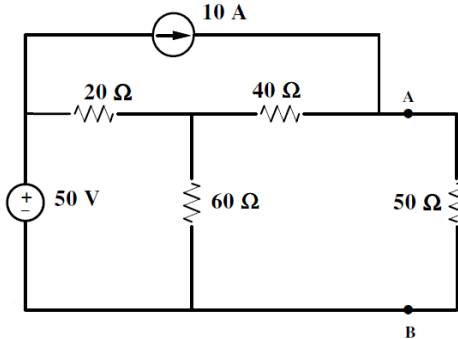


Fig. 1

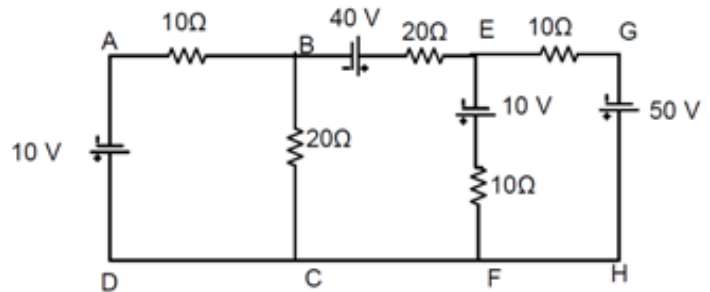


Fig. 2

2. a) What is an ideal transformer? Derive the condition of maximum efficiency for a single phase transformer using common notations. **5 Marks**
- b) In a 50 kVA, 2000/200V, 50 Hz single phase transformer, the iron and copper losses are found to be 1000 W and 600 W at the full load and 0.8 p.f (lag), respectively. Calculate the efficiency of the transformer with same power factor at i) full load and ii) two third of full load. **6 Marks**
- c) Draw the phasor diagram for leading p.f load in a real transformer. **5 Marks**
3. a) Define phasor and phasor diagram. Write short notes on power triangle. **5 Marks**
- b) An alternating current varying sinusoidally with a frequency of 50 Hz has an RMS value of 20 A. Write down the equation for the instantaneous value and find this value a) 0.0025 sec b) 0.0125 sec after passing through a positive maximum value. At what time, measured from a positive maximum value, will the instantaneous current will be 14.14 A? **6 Marks**
- c) A series RLC circuit having a resistance of  $50\Omega$ , an inductance of 500 mH and a capacitance of 400  $\mu\text{F}$ , is energized from a 50 Hz, 230 V, AC supply. Find a) resonant frequency of the circuit b) peak current drawn by the circuit at 50 Hz and c) peak current drawn by the circuit at resonant frequency. **5 Marks**
4. a) Draw the connection diagrams of D.C Generator for different type of excitations. **5 Marks**
- b) A DC shunt generator supplies a 20 kW load at 200V through cables of resistance  $R=100\text{ m}\Omega$ , if the field winding resistance  $R_f=50\ \Omega$  and the armature resistance  $R_a=40\ \text{m}\Omega$ , determine a) the terminal voltage, and b) the emf generated in the armature. **7 Marks**
- c) What is the significance of back EMF in a DC motor? **4 Marks**

5. a) Derive the condition for maximum power transfer from a source to resistive load. **5 Marks**  
 b) What is DC Generator? Derive emf equation in a DC generator. **5 Marks**  
 c) A 220 V shunt motor takes 10.24 A on full-load. The armature resistance is 0.8 ohm and the field resistance is 880 ohm. The losses due to friction windage and the iron amount to 150 W. Find the output power and the efficiency of the motor on full-load. **6 Marks**
6. a) In a series circuit containing pure resistance and a pure inductance, the current and the voltage are expressed as :  $i(t) = 5 \sin(314t + 2\pi/3)A$  and  $v(t) = 15 \sin(314t + 5\pi/6)V$  **2x8=16 Marks**  
 (i) What is the impedance of the circuit? (ii) What is the value of the resistance? (iii) What is the inductance in henrys? (d) What is the average power drawn by the circuit? (e) What is the power factor?
- b) In the network shown in **Fig. 3**, find the value of **Resistance** such that maximum possible power will be transferred to  $R_L$ . Find also the value of the maximum power and the power supplied by source under this condition.

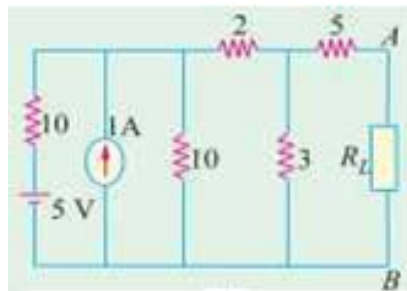


Fig. 3



- (i)  $(1 + x^2)y_2 + 2xy_1 = 0$ ,  
(ii)  $(1 + x^2)y_{n+2} + 2(n + 1)xy_{n+1} + n(n + 1)y_n = 0$ .  
(b) If  $2x = y^{\frac{1}{m}} + y^{-\frac{1}{m}}$ , then show that  $(x^2 - 1)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$ .

7. Answer any one of the following questions: 5X1=5

- (a) State and prove Lagrange's Mean Value theorem.  
(b) Using L' Hospital's rule evaluate  $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x}\right)^{\frac{1}{x}}$ .

8. Answer any one of the following questions: 5X1=5

- (a) If  $I_n = \int_0^{\frac{\pi}{2}} \sin^n x dx$ , then show that  $I_n = \frac{n-1}{n} I_{n-2}$ , and hence find the value of  $\int_0^{\frac{\pi}{2}} \cos^6 x dx$ .  
(b) Show that  $\int_0^{\infty} e^{-x^4} x^2 dx \times \int_0^{\infty} e^{-x^4} dx = \frac{\pi}{8\sqrt{2}}$ .

**Group B (40 Marks)**

**Answer any four questions. ( 10 x 4 = 40)**

- 1.a) Transform the equation  $\sqrt{r} = \sqrt{a} \sin(\theta/2)$  to its Cartesian form.  
b) Find the equation of the three planes passing through the points  $(3,1,1)$ ,  $(1,-2,3)$  parallel to the co-ordinate axes. (5+5)
- 2.a) Evaluate  $\int_C f(x,y)dx$  where  $f(x,y) = x^2 + y^3$  and the curve  $C$  is the arc of the parabola  $y = x^2$  in the  $xy$ -plane from  $(0,0)$  to  $(1,1)$ .  
b) Find the equation of the cone whose vertex is the origin and which passes through the curve of intersection of the plane  $lx + my + nz = p$  and the surface  $ax^2 + by^2 + cz^2 = 1$ . (5+5)
- 3.a) Evaluate  $\int_0^a \int_0^{\sqrt{a^2-y^2}} (x^2 + y^2) dydx$  by changing to polar co-ordinates, with the help of Jacobian.  
b) If the co-ordinates of  $A, B, C, D$  are  $(-1, -2)$ ,  $(7,4)$ ,  $(4,8)$  and  $(-4,2)$  respectively, then show that  $ABCD$  is a rectangle. (7+3)
4. Define limit and continuity of a vector function. If derivative of  $F(t)$  exist at  $t = t_0$ , then prove that  $F(t)$  is continuous at  $t = t_0$ . Is the converse true? Justify your answer. (4+ 3+3)
- 5.a) Evaluate  $\int_0^a \int_0^x \int_0^y x^3 y^2 z dz dy dx$ .  
b) Evaluate  $\int_0^{\pi/2} \int_0^{\pi} \sin(x + y) dy dx$ . (7+3)
6. a) Find the volume of the tetrahedron formed by the four planes  $lx + my + nz = p$ ,  $lx + my = 0$ ,  $my + nz = 0$  and  $nz + lx = 0$ .  
b) State Serret-Frenet's Formulae. (7+3)
7. State Green's theorem for a plane. Verify the theorem for  $\oint_C [(xy + y^2)dx + x^2 dy]$  where  $C$  is the closed curve of the region bounded by  $y = x$  and  $y = x^2$ . (3+7)

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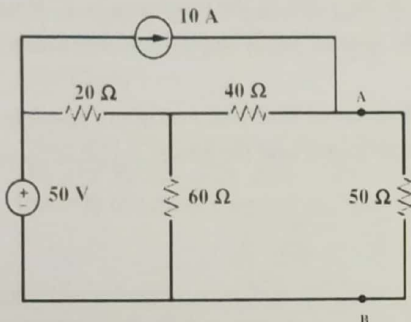


Fig. 1

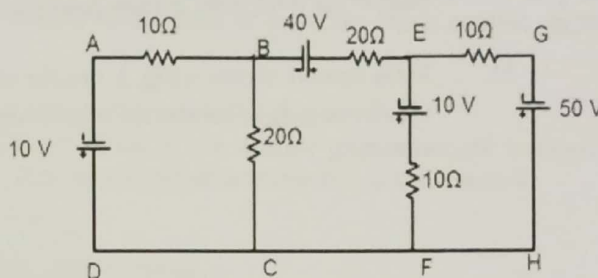


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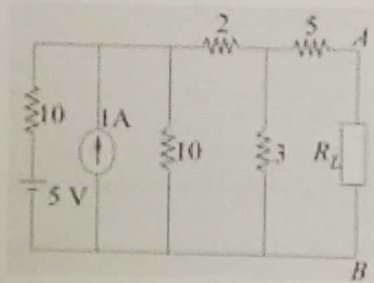


Fig. 3



**ARABIC**

**(USE SEPARATE ANSWER SHEET FOR ARABIC)**

**Q. 1. Attempt any ten, each question carries equal marks**

**2×10=20**

i. Merge the following letters and make a word:

س+ب+ي+ل ، ن+ظ+ي+ف

ii. Identify the letters and Split the following words:

يستبشر، صالحين

iii. Read and write the following words in English:

لُخْرِجَتْهُمْ، لُتَبَيَّنَتْهُ

iv. Identify the following words either 'Noun' (اسم) or 'Verb' (فعل) :

عَالِيَّةٌ، سَوْفَ يَكْتُبُ، الْجَامِعَةُ، قَدْ أَفْلَحَ

v. Change the Gender of following words:

معلمة، طالب، أكبر، قانت.

vi. Identify the following words either definite (المعرفة) or indefinite (النكرة) :

المعلم، طبيب، يَا زَكِي، خَيْرٌ

vii. Write down the Example of Huruf (الحروف) from parts of speech.

viii. Write any four demonstrative Pronouns (اسم الإشارة) of Arabic.

ix. How many kinds of sentence are there in Arabic?

x. How many kinds of Madd are in Arabic? and what are they?

xi. What do you Know about Shaddah ? write in short with example.

xii. Change the Nominal sentence into verbal sentence and Verbal sentence

into Nominal Sentence. رَجَعَ عُمَرُ مِنَ الْمَدْرَسَةِ الولدُ دَخَلَ فِي

الفصل

**Q. 2. Attempt any two Questions, each question carries equal marks.**

**5×4=20**

i. Write the Arabic numbers 1-5 in Arabic scripts.

ii. Write down the any five signs of الفعل (Verb) from the parts of speech (أقسام الكلام) by citing of example.

iii. Write down the Moon Letters (الحروف القمرية) and Sun Letters (الحروف الشمسية) in Arabic.

iv. How to identify Definite Noun (المعرفة) Write any five with example.

v. What do you know about Nominal Sentence (الجملة الاسمية) and Verbal Sentence (الجملة الفعلية) Write down with example.

vi. Write down the signs of femininity (علامة التأنيث) with proper examples.

Examinations 2022-2023

Autumn (Odd) Semester

UG Programme

Course Code : 11111111

Course Title: Compulsory Islamic Studies

Answer Any Four Question :

5x4=20

1. What is the meaning of Tawheed and its types? Describe it.
2. Describe the life of the Prophet Muhammad (PBUH).
3. Discuss about the five daily prayers.
4. What is the Concept of "Risalah" (Prophethood) in Islam? Explain it.
5. Describe the symbol of "Qiyamat." ( Day of Judgement)
6. Write a short note about Roja (Fasting).



# Autumn Semester Examination-2022

Subject: Engineering Physics

Subject Code: PHYUGBS01

Full Marks: 80

Time: 3 hrs

▪ **Answer any eight (8) questions from the following.**

- 1) (a) If  $\mathbf{A} = 2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$  and  $\mathbf{B} = 6\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$ , find the angle between  $\mathbf{A}$  and  $\mathbf{B}$  vectors.  
(b) Show that the vectors  $\mathbf{A} = \mathbf{i} + 4\mathbf{j} + 3\mathbf{k}$  and  $\mathbf{B} = 4\mathbf{i} + 2\mathbf{j} - 4\mathbf{k}$  are mutually perpendicular.  
(c) On application of a force  $5\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$  N, a particle moves from position  $2\mathbf{i} + 5\mathbf{j} + 5\mathbf{k}$  m to another position  $12\mathbf{i} + 15\mathbf{j} + 8\mathbf{k}$ . Calculate the work done.  
(d) Find the area of the parallelogram determined by the vectors  $\mathbf{A} = 3\mathbf{i} + 2\mathbf{j}$  and  $\mathbf{B} = 2\mathbf{j} - 4\mathbf{k}$ .  
(e) If  $|\mathbf{P}| = 10$ ,  $|\mathbf{Q}| = 1$  and  $\mathbf{P} \cdot \mathbf{Q} = 6$ , obtain  $|\mathbf{P} \times \mathbf{Q}|$ . (2x5=10)
- 2) (a) Write Coulomb's law. (b) Write down the properties of electric lines of force.  
(c) Write Gauss's law and express it mathematically. (d) What is an Electric Dipole?  
(e) Calculate the torque on an electric dipole in a uniform electric field. (2x5=10)
- 3) What do you mean by central force? Give some examples of central force. Write down the characteristics of central force. What is the areal velocity. What is the physical significance of cross product? (2 + 1 + 3 + 2 + 2)
- 4) What is Stoke's law and write its equation. Write the difference between the streamline flow and laminar flow. Define equation of continuity. What is Reynolds number and what is the importance of it? What is Bernoulli theorem and its applications? (2 + 3 + 1 + 2 + 2)
- 5) (a) What is Photo electric effect? Explain the effect of increase of incident radiation on photo electric current with suitable graph. Which metal exhibit photo electric effect? (b) State the Heisenberg Uncertainty principle. Write the formula in terms of momentum and position of a system. (c) What is the significance of  $\Psi$  in Schrodinger wave equation? (2+2+2+2+1+1)
- 6) (a) Explain the terms binding energy of a nucleus and the binding energy per nucleon. Show graphically the variation of binding energy per nucleon with mass number. (b) Write the relation between mass number and radius of the nucleus. (c) What is a nuclear reactor? (d) Write the uses of radio isotopes. (2+2+2+1+1+2)
- 7) (a) What is the need for doping in semiconductor? (b) Describe n-type and p-type semiconductors. What are the majority and minority charge carriers in each type of semiconductor? (c) Draw the I-V characteristics curve of a P-N junction in forward bias. (2+2+2+2+2)
- 8) (a) Derive Bragg's law of crystal diffraction. (b) If X-ray of wavelength  $100 \text{ \AA}$  is incident on an atom at an angle of  $90^\circ$ , then what should be the value of  $d$  for first order spectrum? (c) What is the formula for Mosley's law? (d) Write down the comparison between Dia-magnetism, para-magnetism and ferro-magnetism. (3+2+2+3)
- 9) (a) Derive the expression for the fringe width in a Young's double slit experiment. How will the fringe width change if (i) separation between the slits is increased (ii) screen is moved away from the plane of the slits. (b) Define 'Fringes of equal thickness' (FET). Give an example  
(c) Is it possible to have interference without diffraction? (3+1+1)+ (2+1)+ (2)
- 10) (a) Define H-polaroid.  
(b) An EM waves  $E_x(z, t) = E_{0x} \cos(kz - \omega t)$   $E_y(z, t) = E_{0y} \cos(kz - \omega t + \delta)$   
Find the state of polarization in following cases (i)  $\delta = 0, E_{0x} \neq E_{0y}$ ; (ii)  $\delta = \frac{\pi}{2}, E_{0x} = E_{0y}$ ;  
(c) What are the difference between the Fraunhofer diffraction and the Fresnel diffraction?  
(d) Define Laevo-rotatory substance. (2+(2+2)+2+2)

**“UG” END SEMESTER EXAMINATION – FEBRUARY, 2023**  
**(REGULAR-ODD SEMESTER)**  
**1<sup>ST</sup> YEAR (1<sup>ST</sup> SEMESTER)**  
**ENGINEERING MECHANICS**  
**MENUGES01**

(Full Marks – 80)

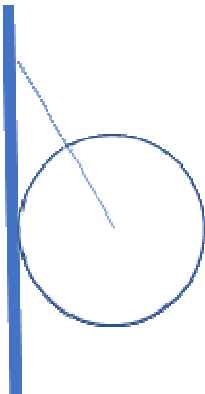
(Time – 3 Hours)

(Assume missing data if any)

**Group- A.**

(Answer **any five** questions)[5x (3+5) =40]

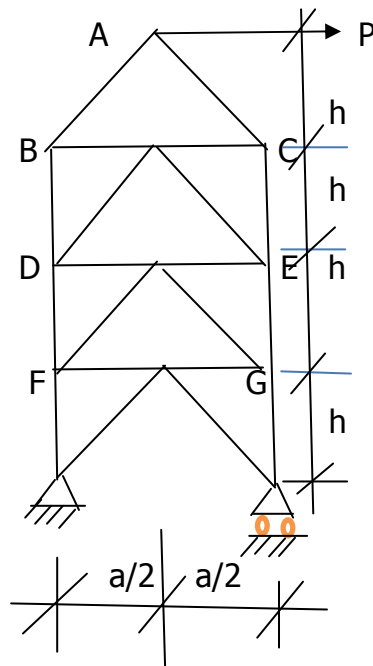
1. (a) State the polygon law (vector). Why current is not treated as vector quantity?  
(b) A rigid body is spinning with an angular velocity of  $3\text{rad/sec}$  about an axis parallel to  $2\mathbf{i}+\mathbf{j}-2\mathbf{k}$  passing through the point  $\mathbf{i}+3\mathbf{j}-\mathbf{k}$ . Find the velocity of the point of the body whose position vector is  $4\mathbf{i}+8\mathbf{j}+\mathbf{k}$ .
2. (a) State the principle of resolution of forces. What is the moment of couple?  
(b) The forces 20N, 30N, 40N, 50N and 60N are acting at one angular point of regular hexagon, towards the other five points, taken in order. Find the magnitude and direction of the resultant
- 3.(a) State the principle of equilibrium of a body and equilibrium forces.  
(b) Draw the F.B.D of following figure and find the reaction on wall & tension in the rope. Length of rope is 10cm, the angle between rope and wall is  $30^\circ$  & weight of ball is 100 N.



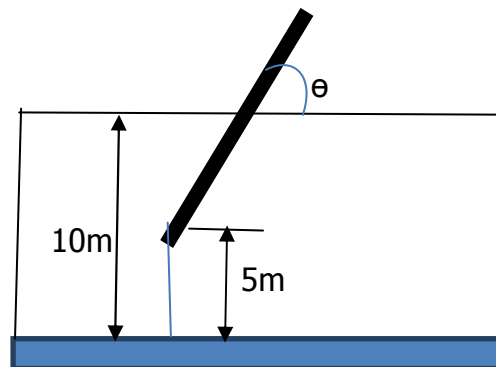
4. (a) What is friction force? State three Coulomb's Law for dry friction.  
(b) A uniform ladder of weight 250N rests against a smooth vertical wall and a rough horizontal floor making an angle of  $45^\circ$  with horizontal. Find the force of friction at the floor using method of virtual works.
5. (a) What are the assumptions of truss? State the differences between truss and frame.  
(b) Find the axial force in members DF and EG in the given figure (Next Page).

**[Turn Over]**

(2)



6. (a) Define Mass Moment of Inertia & radius of Gyration.  
(b) Find Mass moment of Inertia of cylinder having height "h" & radius "R".
7. (a) Define static fluid. What will be the shear force if a fluid is in rest?  
(b) A buoy in the form of a uniform 8m pole 0.2m dia has a mass of 200kg and is secured at its lower end to the bottom of a fresh water lake with 5m of cable. If the depth of the water is 10m, calculate the angle, made by the pole to the horizontal. Assume "g" =9.81 m/s<sup>2</sup>.



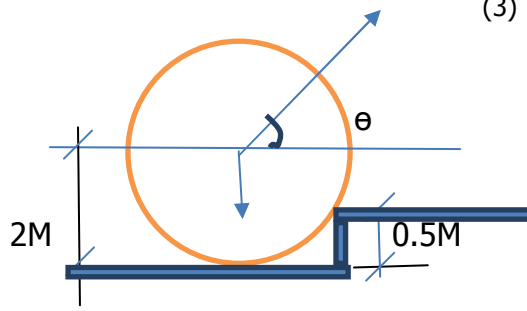
**Group-B**

(Answer **four questions** only)

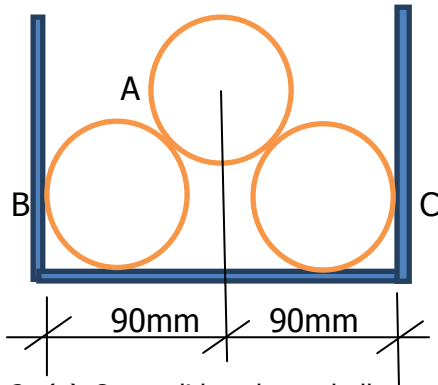
[4x (10) =40]

1. (a) Find Minimum force "P" to just start the roller as shown in figure (Next Page). Given Weight of Roller is 100N.

(3)

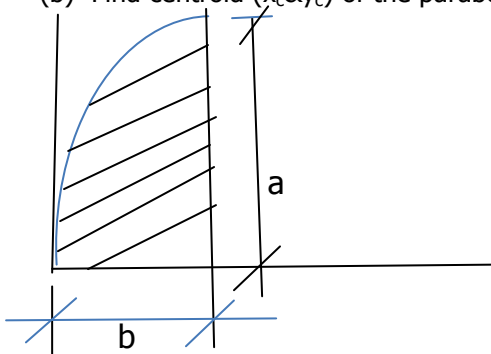


- (b) Three Cylinders weighing 100N each and of 80mm dia are placed in a channel of 180mm width as shown in figure. Determine the pressure exerted by (i) the cylinder A on B at the point of contact, (ii) the cylinder on the wall. **[3+7]**



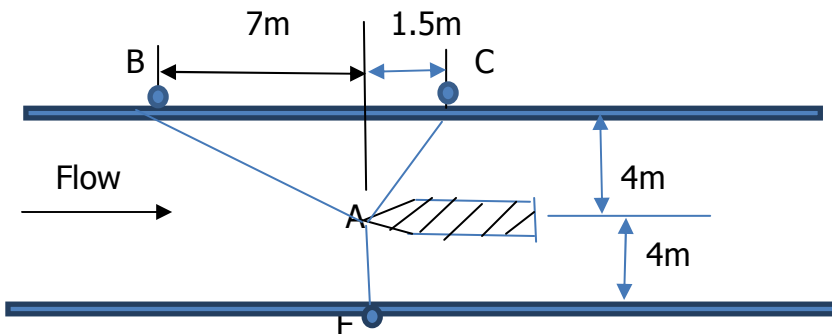
2. (a) One solid and one hollow cylinder having same mass are kept on two inclined planes with same inclination and same height from the ground. Now both the cylinders are freed to move on the planes. Which cylinder will reach the ground first? Justify your reason.

- (b) Find centroid ( $x_c$  &  $y_c$ ) of the parabola  $x=ky^2$  as shown in figure. **[2+8]**



3. (a) State Lami's theorem

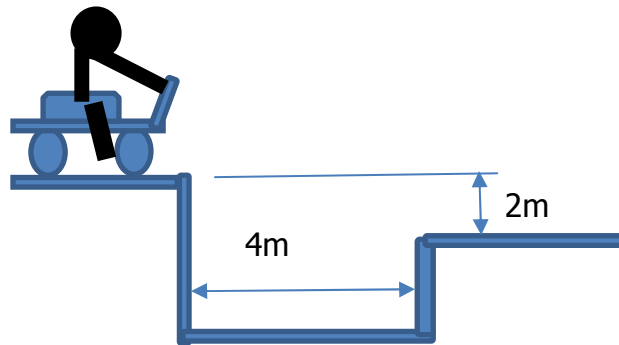
- (b) For a new sailboat, a designer wants to determine the drag force that may be expected at a given speed. To do so she places a model of the proposed hull in a test channel and uses three cables to keep its bow on the centreline of the channel. Dynamometer readings indicate that for a given speed, the tension is 200N in cable AB and 300N in cable AE. Determine the drag force exerted on the hull and the tension in cable AC. **[2+8]**



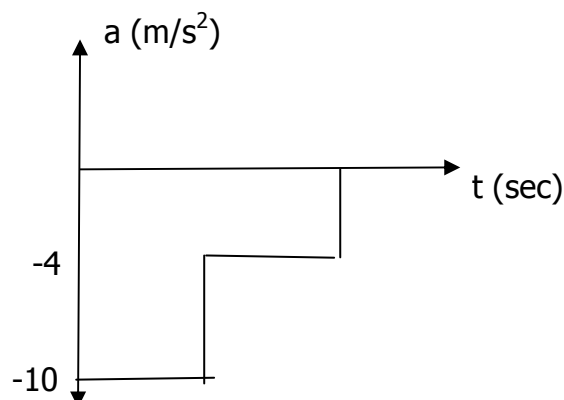
[Turn Over]

(4)

4. (a) A hollow steel tube 3.5m long has external diameter of 120mm. In order to determine the internal dia, the tube was subjected to tensile load of 400kN and its extension was measured to be 2mm. If the modulus of elasticity for the tube material is 200 GPa, determine the internal dia of the tube.
- (b) A composite shaft is made by enclosing aluminium rod of 60mm dia, in brass tube of 10mm thickness. A composite shaft is subjected to a Torque of 5kN-m, find the maximum shear stress in both the shafts (Given Modulus of Rigidity,  $G=28$  GPa & 40 GPa for Aluminium and Brass Respectively). **[5+5]**
5. (a) A gun fires two bullets at 300 and 600 with horizontal. They have the same range. The ratio of their maximum height will be \_\_\_\_\_?
- (b) A motorcyclist wants to jump over a ditch as shown. Find the minimum velocity necessary at point A in km/hr. Also find inclination and magnitude of the velocity of the motor cycle just after clearing the ditch. **[3+7]**

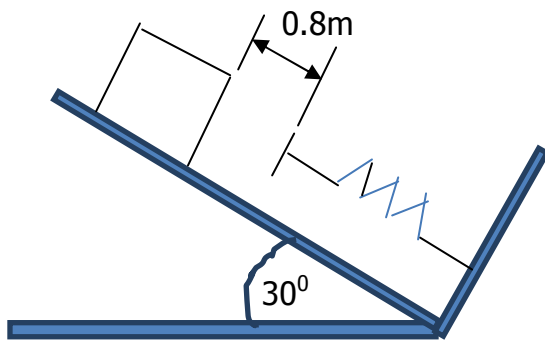


6. (a) A car starts from rest with an acceleration of  $4\text{m/s}^2$ . What is the distance travelled by the car in 8<sup>th</sup> sec of its travel?
- (b) Car A starts from rest at  $t=0$  and travels along straight road with a constant acceleration of  $2\text{m/s}^2$  until it reaches a speed of 25m/s. Afterwards it maintains this speed. Also, when  $t=0$ , car B located at 2000m down the road is travelling towards car A at a constant speed of 20m/s. Determine the distance travelled car A when they pass each other. **[3+7]**
7. (a) The acceleration of a particle is given by  $a=10/(v+1)$ , where  $a$  is the acceleration in  $\text{m/s}^2$  and  $v$  is the velocity in  $\text{m/s}$ . The particle starts with zero initial velocity. Find the distance (in m) in which the particle will attain a velocity of 10m/s.
- (b) An aeroplane travelling at 70m/s lands on a straight runway and has a deceleration described by the following graph. Determine the time,  $t$ , in sec to reach a speed of 5m/s. **[5+5]**

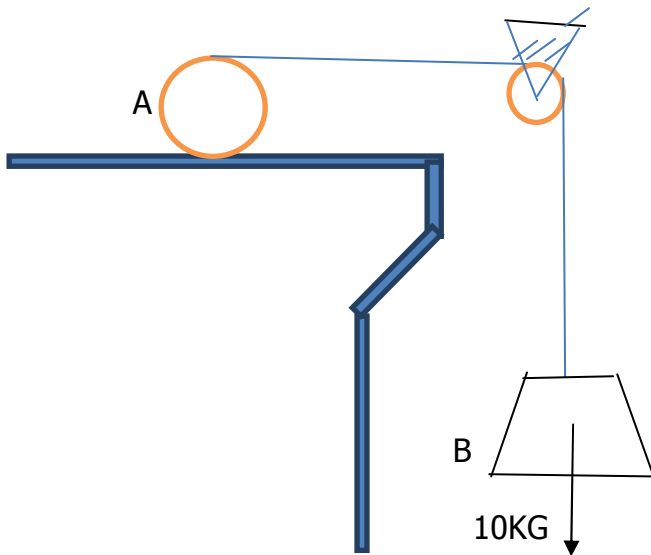


8. (a) A block of mass 5kg resting on a  $30^\circ$  inclined plane is released from rest. After travelling a distance of 0.8m along the plane, the block hits a spring of stiffness 1m/mm. Find the maximum compression of the spring (in mm). Assume co-eff of friction  $=0.2$  and  $g=10\text{m/s}^2$ .

(5)



- (b) Find the acceleration of a solid right circular roller "A" of mass  $20\text{ kg}$  when it is being pulled by another body "B" of mass  $10\text{ kg}$  along a horizontal plane as shown in figure. The mass "B" is attached to the end of a string wound round the circumference of the roller. Assume that there is no slipping of the roller, the string is inextensible and Pulley is frictionless. **[5+5]**



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