AIKTC/KRRC/SoET/ACKN/QUES/2018-19/ **Date:** _____

School: SoET-CBSGS **Branch:** ALL BRANCHES **SEM:** I

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Applied Mathematics- I	FEC101			
2	Applied Physics- I	FEC102		✓	02
3	Applied Chemistry- I	FEC103			
4	Engineering Mechanics	FEC104		✓	02
5	Basic electrical & electronic Engineering	FEC105			
6	Environmental studies	FEC106			

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

FE - Sem - I - CBSGS

(5)

3/6/19

Paper / Subject Code: 58505 / Applied Physics - I.

Q. P. Code: 27426

Time: 2 hours Marks: 60

1. Question number 1 is compulsory
2. Attempt any three from remaining
3. Figure to right indicates marks
4. Assume necessary data

Q1 attempt **any 5** from following 15

1. Explain the steps to calculate the Miller indices of a plane.
2. Calculate the distance between two carbon atoms of a basis of the diamond structure, if the lattice constant of structure is 5 Å.
3. Draw the diagrams to show the variation of fermi level with temperature for n-type and p-type semiconductors.
4. Define reverberation of time. State the factors on which it depends upon.
5. Calculate the number of turns required to produce a flux of 10^{-3} Wb around an iron ring of 5 cm^2 cross section and 20 mm mean diameter having an air gap of 2 mm wide across it. The relative permeability of iron is 1000.
6. Two parallel plate capacitors having equal and opposite charges are separated by a dielectric slab of thickness 2 cm. If the electric field inside is 10^6 V and dielectric constant is 3, calculate the polarization and displacement density.
7. Explain the statement "crystal acts as three dimensional grating with X-rays".

Q.2) **a.** Explain Hall effect & its significance. A bar of n type Ge of size 0.010 m x 0.001 m is mounted in a magnetic field of 2×10^{-1}T. The electron density in the bar is $7 \times 10^{21}/m^3$. If one millivoilt is applied across the long ends of the bar, determine the current through the bar and the voltage between Hall electrodes placed across the short dimensions of the bar. Assume $\mu_e = 0.39\ m^2/vs$. 8

b. Explain various point defects in crystals. Estimate the number of Frenkel defects per mm^3 in AgCl if energy of formation of frenkel defects is 1.5 eV at 700^0K. The molecular weight of AgCl is 0.143 kg/mol and specific density is 5.56. 7

Q.3) **a.** Draw the unit cell of HCP. Derive the number of atoms/unit cell, the c/a ratio and the void space percentage. 8

b. With a neat labelled diagram explain the principle, construction and working of a piezoelectric oscillator. 7

Q.4) a. For an intrinsic semiconductor show that the Fermi level lies in the centre of the forbidden energy gap. 5

b. Calculate the energy loss per minute in the core (of mass 40 Kg) of a transformer, if area of the hysteresis loop is 1900 erg/cc. Frequency is 100 cycles/sec and density of the material of the core is 7.5 gm/cc

c. Derive the relation between polarization, dielectric susceptibility and dielectric constant. 5

Q. 5) a. Explain the determination of the crystal structure using Braggs spectrometer. 5

b. If a gas contains 1.2×10^{27} atoms/m^3 and radius of atom is 0.53 Å, then calculate electronic polarizability and dielectric constant. Find the capacitance of a parallel plate capacitor having this gas inside with plate area 1cm^2 and plate separation 0.12 cm. 5

c. Define Ligancy and critical radius ratio in case of ionic solid. Write the conditions for stability of ionic crystals in 3-D. 5

Q.6) a. Two ships are anchored at certain distance between them. An ultrasonic signal of 50 KHz is sent from one ship to another via 2 routes. First through water and second through atmosphere. The difference between the time intervals for receiving the signals at the other ship is 2 seconds. If the velocity of sound in atmosphere and seawater are 348 m/s and 1392 m/s respectively, find the distance between the ships. Also find the time taken by the signal to travel through water. 5

b. Explain principle, construction & working of a solar cell. 5

c. Distinguish between diamagnetic, paramagnetic & ferromagnetic materials. 5

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(6) F.E – sem – I – CBSGS – (Engg Mech.) 16/5/19

Paper / Subject Code: 58502 / Engineering Mechanics.

Q. P. Code: 40005

(3 Hours)

Total Marks : 80

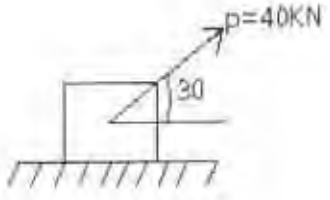
N.B.1. Question No. 1 is Compulsory.
2. Answer any Three more questions out of the remaining Five questions.
3. Assume any suitable data wherever required but justify the same.
4. Figures to the right indicate full mark
5. Take g= 9.81m/s^2

Q1. Attempt any four.

a) Replace four like parallel forces A,B,C,D of magnitudes 5N,10N,15N,20N respectively with 2m distance between each other by i) a force –couple system at the point of application of first force A. ii) a single resultant with respect to the first force A. [5]

b)State and prove Lami's Theorem . [5]

c) A block weighing 200KN is placed on rough horizontal plane. A pull force of 40KN is applied at an angle 30^0 on it. If the block is just on the point of moving, find Coefficient of friction and Angle of friction. [5]

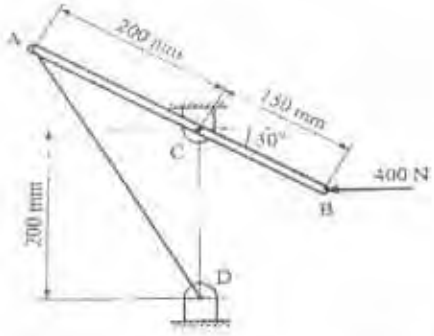


d) A car moves in a circular path of 2m radius. At an instant its speed is increasing at the rate of 6m/s^2 and its total acceleration is 10m/s^2. Determine the speed of car at this instant. [5]

e) A car travelling at a speed of 60kmph is braked and comes to rest in 6 seconds after the brakes are applied. Find the minimum coefficient of friction between the wheels and the road. [5]

Q2a). A lever AB is hinged at C and attached to a cable at A. If the lever is subjected at B to a 400N horizontal force, determine [8]

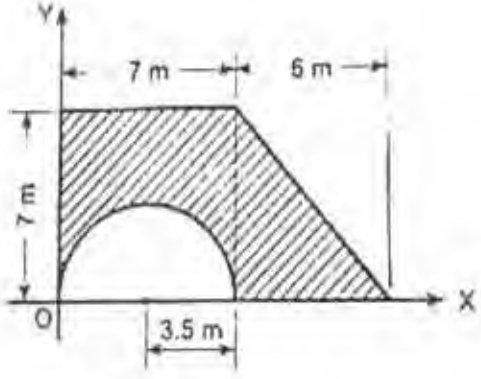
(i) Tension in the cable AD (ii)The reaction at C.



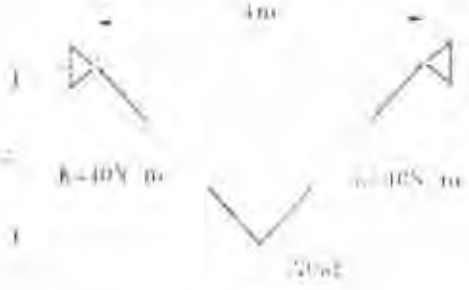
b) Find the resultant of the force system acting on a body OABC, shown in figure. Also find the points where the resultant will cut the x and y axes. What is the distance of resultant from point 'O' ? [6]

c) A boy throws a ball vertically downwards from a height of 1.5m. He wants to rebound it from floor and just touch the ceiling of room which is at a height of 4m from ground. If coefficient of restitution is 0.8. find the initial velocity with which the ball should be thrown. [6]

Q3.a) Determine the Centroid of the shaded area. Refer Fig(a) [8]



Fig(a)



Fig(b)

b) A cylinder has mass 20 kg and is released from rest, when h= 0. Determine the speed when h= 4 m. The spring has an un-stretched length of 2 m. Refer Fig(b). [6]

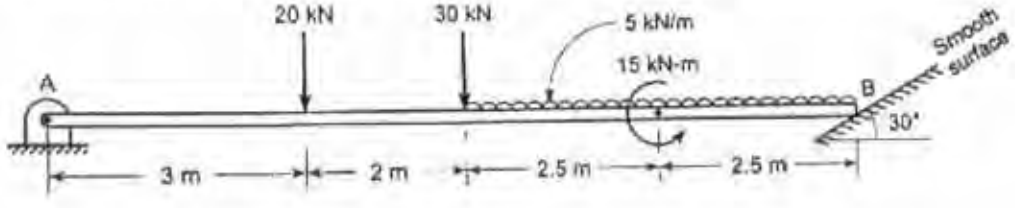
c) Replace the given force system by a force couple system at point P (0,2,1).

$\mathbf{F_1}$= (12i+ 16j+3k) N acts at point A (0,0,3) m.

$\mathbf{F_2}$ = (7i+6j) N acts at point B(3,-2,0) and a couple with moment

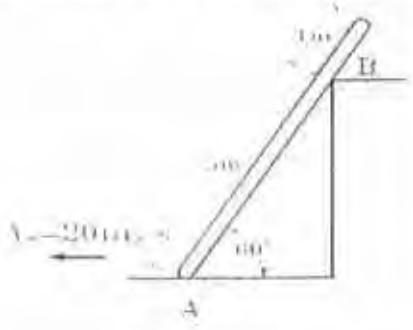
M= (20k) N m [6]

Q4.a) Find support reactions at A and B for the beam loaded as shown in Fig(7). [8]



b) An aeroplane is flying in a horizontal direction with a velocity of 540kmph at a height of 3000m. When it is vertically above the point A on the ground, a box is dropped from it. The box strikes the ground at a point B. Calculate the distance AB on the ground. Neglect air resistance. [6]

c) Velocity of point A on rod is 20 m/s at the instant shown in Fig(c). Locate ICR for the rod and determine velocity of point B on the rod. [6]



Fig(c)

Fig(d)

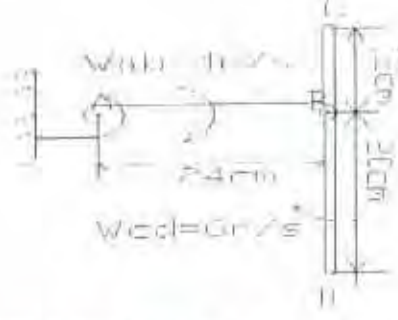
Q5a) For the truss shown in Fig(d), determine

(i)Forces in members EF, CF and BC by method of sections only. [3]

(ii)Forces in all other members by method of joints [5]

b) A motorcycle starts from rest and accelerates at $2m/s^2$ till velocity reaches 10m/s. Then it accelerates at $1m/s^2$ till velocity reaches 15m/s and continues at uniform velocity of 15m/s till it covers a total distance of 300m. Find the total time taken to cover this distance. Draw the v-t and x-t graph for this motion. [6]

c) A bar AB is hinged to wall at A. Another bar CD is connected to it by a pin at B such that CB=12cm. and BD=20cm. At the instant shown in Fig, AB is perpendicular to CD and the angular velocities of bar AB is 4rad/sec and that of CD is 6rad/sec both clockwise. Determine the linear velocities of points C and D. [Note:- bar CD is in plane motion] . [6]



Q6 a) A uniform ladder of length 4m rests against a rough vertical wall with its lower end on a rough horizontal floor, the ladder being inclined at 50^0 to the horizontal. The coefficient of friction between the ladder and the wall is 0.3 and that between the ladder and the floor is 0.5. A man of weight 500N ascends up the ladder. What is the maximum length up along the ladder, the man will

be able to ascend before the ladder commences to slip. The weight of the ladder is 1000N. [8]

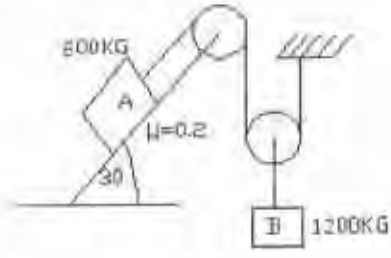
b) Write down the conditions of equilibrium for Forces in Space for

(i) con-current system (ii) parallel system and (iii) general system . [6]

c) The velocity of a particle moving along a straight line is given by $v=2t^3+6t^2$ where v is in m/sec and t is in seconds. Determine its acceleration and displacement at t=5sec after it starts from origin.

or

c) Blocks A and B of mass 600kg and 1200kg respectively are connected by a string passing over a smooth pulley. Neglect mass of pulley. If coefficient of kinetic friction between the block A and the inclined surface is 0.2, determine the acceleration of block A and block B. Refer Fig. [6]



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