Elements of Civil Engineering & Mechanics VTU CBCS Question Paper Set 2018

CBCS Scheme

USN | | | | | | | | | | |

17CIV13

First Semester B.E. Degree Examination, Dec.2017/Jan.2018
Elements of Civil Engineering & Mechanics

Time: 3 hrs. Max. Marks: 100

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Briefly give the scope of different fields in Civil Engineering. **(10 Marks)**

b. List and briefly explain the types of force systems with example. **(10 Marks)**

OR

2 a. Write the classification of roads and comparison of flexible and rigid pavements. **(10 Marks)**

b. The moment of certain force 'F' is 180 kN-m clockwise about 'O' and 90kN-m counter clockwise about 'B'. If its moment about 'A' is zero, determine the force 'F'. Refer fig.Q2(b). **(10 Marks)**

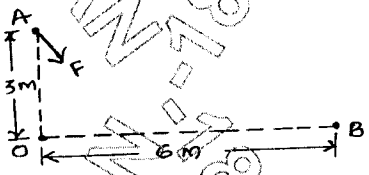


Fig.Q2(b)

Module-2

3 a. State and prove Parallelogram law of forces and also write the significance of the law. **(10 Marks)**

b. In the fig. Q3(b) the portion BC of the string is horizontal and pulley is frictionless. Determine tensions in different segments of the string. Also find W1 and W2. Use Lami's theorem. **(10 Marks)**

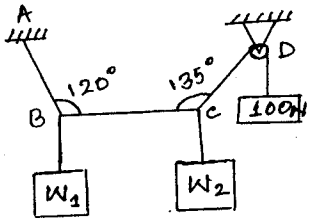


Fig.Q3(b)

OR

4 a. Define the terms : i) Angle of friction ii) Cone of friction. **(04 Marks)**

b. What should be the value of θ if fig. Q4(b) which will make the motion of 900N block down the plane to impend? The coefficient of friction for all contact surfaces is 1/3. **(06 Marks)**

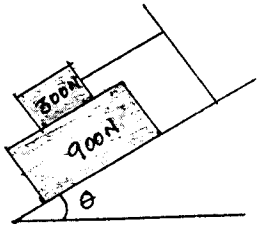
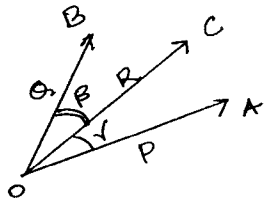


Fig.Q4(b)

c. Two forces P & Q are acting at point 'O' as shown in fig. Q4(c). the resultant force is 400N, angles β and γ are 35^0 and 25^0 respectively. Find the two forces P and Q. **(10 Marks)**

Fig.Q4(c)

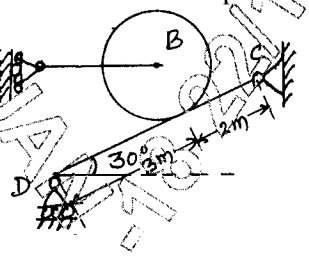


Module-3

5 a. Explain i) Types of loads ii) Types of support. **(10 Marks)**

b. A roller weighing 2000N rests on an inclined bar, which is 5m long and weighing 800N as shown in fig. Q5(b). Determine the reactions developed at supports C and D. **(10 Marks)**

Fig.Q5(b)

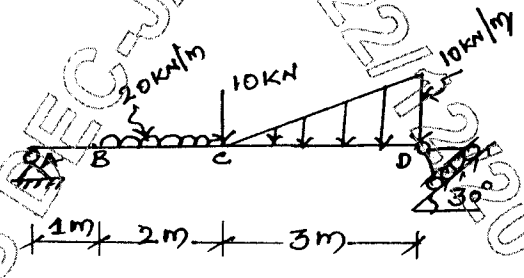


OR

6 a. State and prove 'Principle of Moments'. **(10 Marks)**

b. Determine the reactions at the supports for the beam loaded as shown in fig. Q6(b). **(10 Marks)**

Fig.Q6(b)

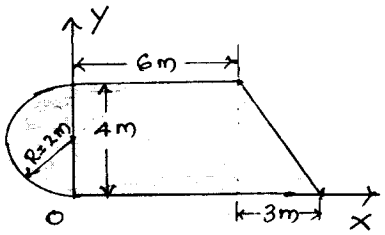


Module-4

7 a. Determine the centroid of a right angle triangle of base 'b' and height 'h' from first principle. **(08 Marks)**

b. Determine the centroid of the area shown in fig. Q7(b) with respect to the axes shown. **(12 Marks)**

Fig.Q7(b)



OR

8 a. Determine the moment of Inertia of a circle about its diametral axis by the method of integration. **(06 Marks)**

b. Determine the moment of inertia of the section shown in fig. Q8(b) about the Vertical Centroidal axis. All dimensions are in mm. **(14 Marks)**

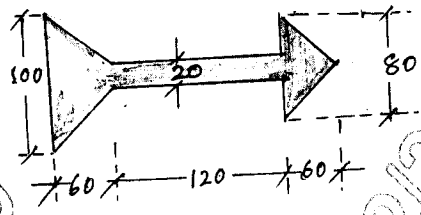


Fig.Q8(b)

Module-5

9 a. State and explain Newton's laws of motion. **(10 Marks)**

b. On a straight road, a smuggler's car passes a police station with uniform velocity of 10m/sec. After 10 secs, a police van follows in pursuit with a uniform acceleration of 1m/sec^2. Find the time necessary for the police van to catch up with the smuggler's car. **(10 Marks)**

OR

10 a. What is Projectile? Define the terms i) Angle of projection ii) Horizontal range. **(06 Marks)**

b. Define : i) Centrifugal force ii) Super elevation. **(04 Marks)**

c. Find the least initial velocity with which a projectile is to be projected so that it clears a wall of 4m height located at a distance of 5m, and strikes the ground at a distance 4m beyond the wall as shown in fig. Q10(c). The point of projection is at the same level as the foot of the wall. **(10 Marks)**

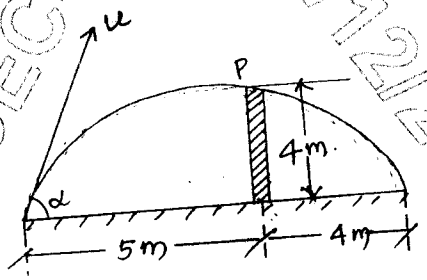


Fig.Q10(c)

* * * * *

CBCS Scheme

15CIV13/23

USN

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Name different fields of civil engineering and explain any two of them. **(06 Marks)**

b. With neat sketch, explain any two types of dams. **(06 Marks)**

c. Find the moment of 500N force about points A, B, C and D as shown in Fig.Q1(C). **(04 Marks)**

OR

2 a. Explain the role of civil engineer in infrastructural development of the country. **(06 Marks)**

b. Explain the Nagpur road plan classification. **(06 Marks)**

c. A square ABCD has forces acting along its sides as shown in Fig.Q2(c). Find the value of P and Q, if the system reduces to a couple. Also find magnitude of the couple if the side of the square is 2m. **(04 Marks)**

Module-2

3 a. State and prove parallelogram law of forces. **(06 Marks)**

b. The forces acting on the system are shown in Fig.Q2(b). Determine the magnitude and direction of the resultants. **(06 Marks)**

c. With neat sketches explain angle of friction, angle of repose and cone of friction. **(04 Marks)**

OR

4 a. State laws of dry friction. **(04 Marks)**

b. A chord supported at A and B carries a load of 100kN at D and a load of W at C as shown in Fig.Q4(b). Find the values of W so that CD remains horizontal. Also determine tension in each chord. **(06 Marks)**

c. A block weighing 4000N is resting on horizontal surface supports another block of 2000N as shown in Fig.Q4(c). Find the horizontal force F just to move the block to the left. Take co-efficient of friction for all surfaces of contact to be 0.2. **(06 Marks)**

Module-3

5 a. State and prove Verignon's principle of moments. **(06 Marks)**

b. A rigid plat is subjected to the forces as shown in Fig.Q5(b). Compute magnitude direction and position of resultant force with respect to centroid point O of the plate. **(06 Marks)**

c. Determine the support reactions for the beam shown in Fig.Q5(c). **(04 Marks)**

OR

6 a. With neat sketches indicating the reactions explain types of supports. **(04 Marks)**

b. The forces acting on 1m length of a dam are as shown in Fig.Q6(b). Determine the magnitude, direction and position of resultant from O. **(06 Marks)**

c. A uniform beam AB hinged at A, is kept horizontal by supporting and settling a 400kN with the help of a rope tied at B and passing over smooth pulley at C. The bar weights 200kN. Determine the reactions at the supports A and C as well as the tension in the string. Refer Fig.Q6(c). **(06 Marks)**

Module-4

7 a. State and prove parallel axis theorem. **(05 Marks)**

b. From first principles determine the centroid of a rectangle. **(05 Marks)**

c. Determine the centroid of the area shown in Fig.A7(c) with respect to the axis shown. **(06 Marks)**

OR

8 a. From first principles determine the centriod of quarter circle. **(06 Marks)**

b. Determine the moment of inertia of the symmetric I section shown in Fig.Q8(b) about its centriodal x – x axis and y – y axis. Also determine polar moment of inertia. **(10 Marks)**

Module-5

9 a. Derive the expression for maximum height attained by the projectile. **(05 Marks)**

b. A car starts from rest and accelerates uniformly to a speed of 75 kmph over a distanced of 1000M. Find acceleration of the car and time taken to attain this speed. If a further acceleration rises the speed to 100kmph in 10sec, find the new acceleration and the further distance moved. **(05 Marks)**

c. The equation of motion of particle is given by $a = 4t^3 - 3t^2 + 6$ where a : acceleration in m/sec^2 and t : time in seconds. The velocity of the particle at t = 1 second is 5.0 m/sec and displacement is 10m. Determine the displacement and velocity at t = 5 seconds. **(06 Marks)**

OR

10 a. What is super elevation? Explain the objects of providing super elevation. **(04 Marks)**

b. A ball was thrown vertically upwards from the ground with the velocity of 60m/sec. After 3 seconds another ball was thrown vertically upwards from the ground. If both the balls strike the ground at the same time, determine the velocity with which the second ball was thrown. **(06 Marks)**

c. A particle is projected in air with a velocity of 120m/sec at an angle of 30° with the horizontal. Determine :

i) The horizontal range

ii) Maximum height attained by the particle

iii) The time of flight. **(06 Marks)**

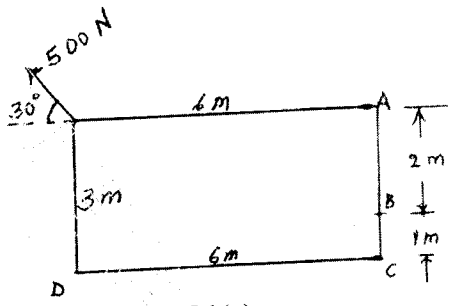


Fig.Q1(c)

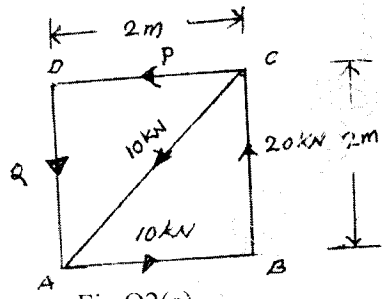


Fig.Q2(c)

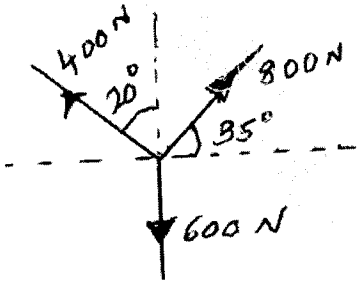


Fig.Q3(b)

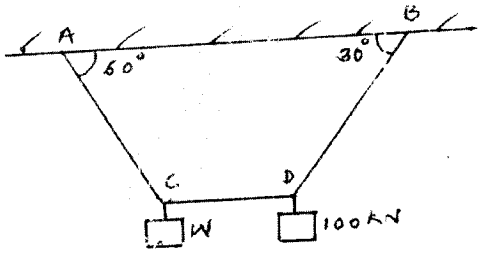


Fig.Q4(b)

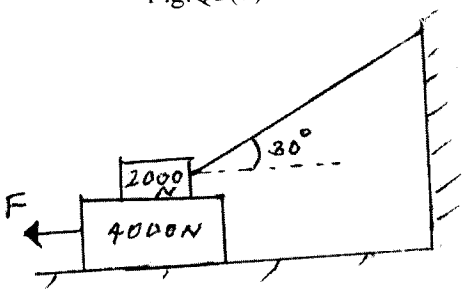


Fig.Q4(c)

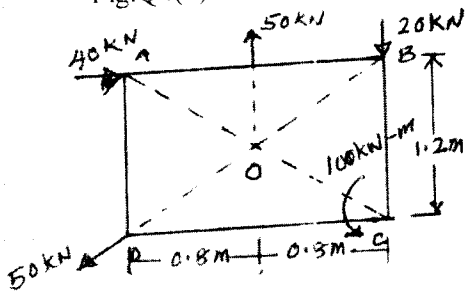


Fig.Q5(b)

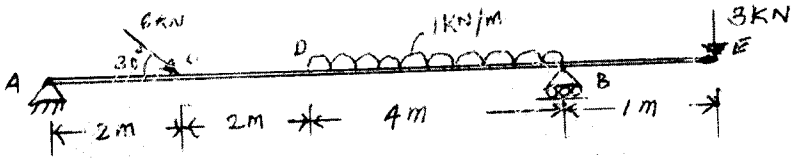


Fig.Q5(C)

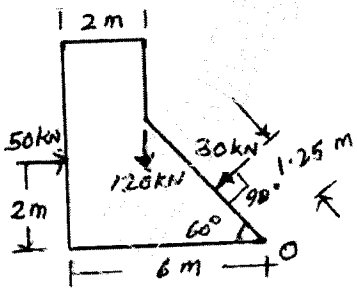


Fig.Q6(b)

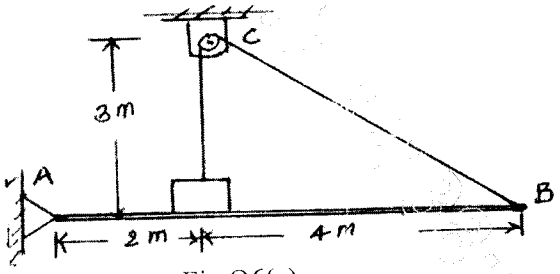


Fig.Q6(c)

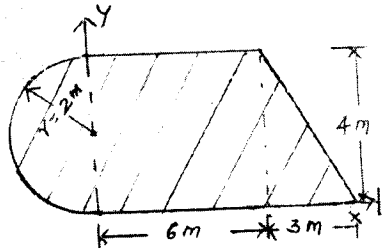


Fig.Q7(c)

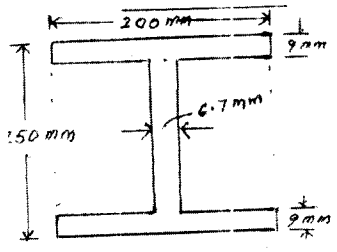


Fig.Q8(b)

CBCS SCHEME

USN | | | | | | | | | | |

15CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2016
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:80

Note: ***Answer any FIVE full questions choosing ONE full question from each Module.***

MODULE - 1

1 a. What is the role played by a Civil Engineer in the infrastructure development of a country? **(08 Marks)**

b. Replace the force couple system by a single force with respect to AB and CD as shown in fig.1(b). **(06 Marks)**

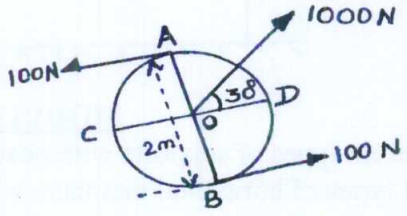


Fig.Q1(b)

c. Define Moment of a Force. **(02 Marks)**

2 a. What is the scope of (1) Environmental Engineering (2) Surveying? **(06 Marks)**

b. Distinguish between Rigid pavement and Flexible pavement. **(06 Marks)**

c. Fig.Q2(c) shows a cantilever beam with two forces and a couple i) Determine the resultant of a system ii) Determine an equivalent system through A. **(04 Marks)**

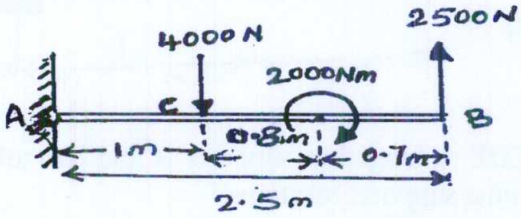


Fig.Q2(c)

MODULE - 2

3 a. Define the following : i) Equilibrant ii) Resultant force iii) Angle of friction iv) Angle of Repose. **(08 Marks)**

b. A vertical mast AC as shown in fig.Q3(b) supports two cables with tension 3kN and 7kN at the angles shown. BC is a guy wire to be situated at a distance X from the mast base. The resultant of the force system is limited to 2kN maximum and must acts vertically down the mast. Calculate the value of the distance X. **(08 Marks)**

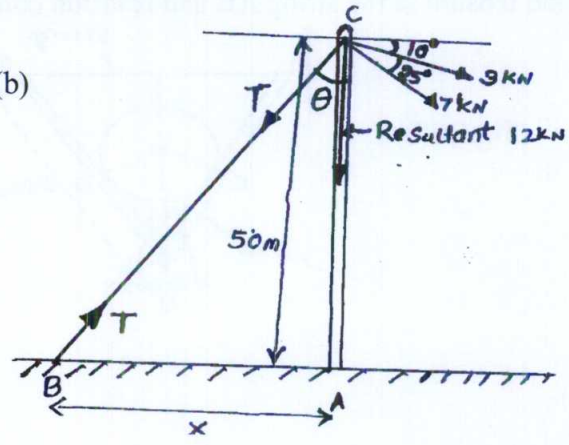


Fig.Q3(b)

4 a. Explain different types of frictions. **(04 Marks)**

b. State and prove Lami's theorem. **(04 Marks)**

c. Figure Q4(c) shows two blocks along with values of μ. Determine the force Q to be applied for impending motion between A and B. Will this force cause movement between B and the ground? **(08 Marks)**

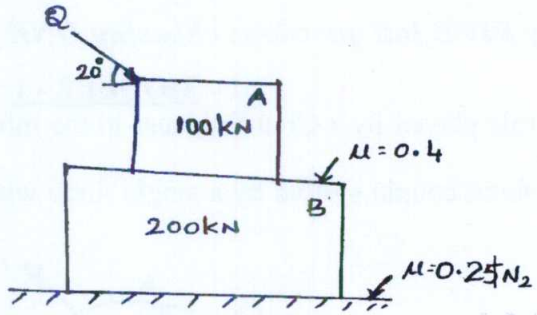


Fig.Q4(c)

MODULE - 3

5 a. Mention the different types of supports with neat sketch. **(04 Marks)**

b. Explain different types of horizontal members which generally placed on supports. **(04 Marks)**

c. Determine the reactions at A and B of the overhanging beam as shown in fig. Q5(c). **(08 Marks)**

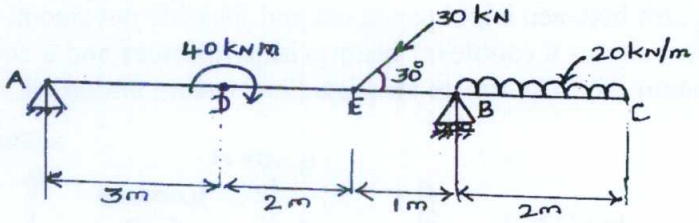


Fig.Q5(c)

6 a. A beam ABCDE is hinged at supports B and has roller at C carries load as shown in fig. Q6(a). Determine supports reactions. **(08 Marks)**

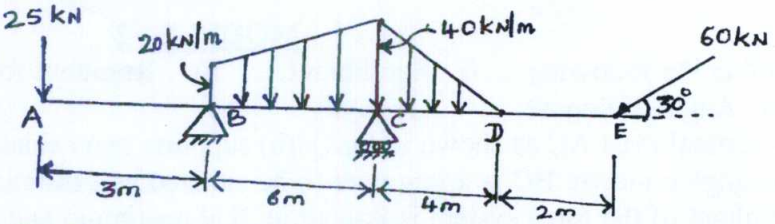


Fig.Q6(a)

b. A cylinder of radius 50mm and weighing 200N is kept in equilibrium portion as shown in fig. Q6(b). Find tension in the string AB and reaction component at hinge O. **(08 Marks)**

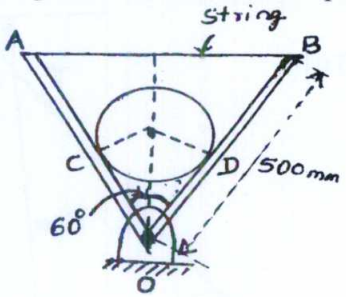


Fig.Q6(b)

MODULE - 4

7 a. State and prove parallel axis theorem. **(06 Marks)**

b. Determine the position of centroid of the lamina with circular cutout as shown in fig. Q7(b). **(10 Marks)**

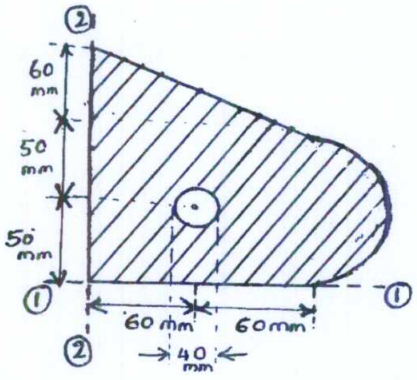


Fig.Q7(b)

8 a. Determine Centroid of a triangle by method of Integration. **(06 Marks)**

b. Find the moment of Inertia of the region in fig. Q8(b) about horizontal axis ①-① and also find the radius of gyration about the same axis. **(10 Marks)**

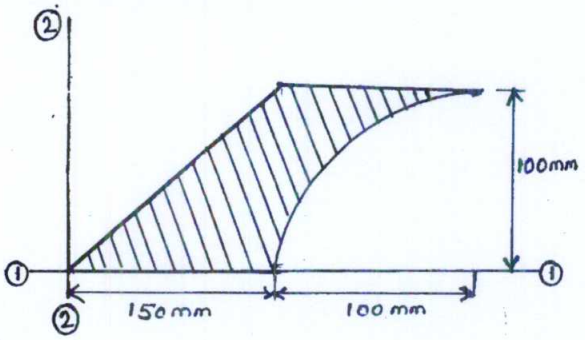


Fig.Q8(b)

MODULE - 5

9 a. Define the following : i) Kinematics ii) Kinetics iii) Motion iv) Path. **(04 Marks)**

b. What is Super elevation and what is its necessity? **(04 Marks)**

c. A projectile is projected from a point at an angle of elevation of 30^0 with a velocity of 600m/sec. Find the velocity and direction of motion of the particle at the end of
i) 25 seconds ii) 40 seconds. **(08 Marks)**

10 a. Define the following : i) Uniform velocity ii) Rectilinear motion iii) Curvilinear motion iv) Projectile. **(04 Marks)**

b. A particle falling under gravity falls 30 meters in a certain second. Find the time required to cover the next 30 meters. Take $g = 9.8m/sec^2$. **(04 Marks)**

c. A vehicle carrying a vertical rocket launcher moves to the right at a constant velocity 35m/s along horizontal track. It launches a rocket vertically upwards with an initial velocity of 45m/s relative to the vehicle.
i) How high will the rocket go up?
ii) Where will the rocket land relative to the vehicle?
iii) How far does the vehicle move while the rocket is in the air?
iv) At what angle relative to the horizontal is the rocket travelling just when it leaves the vehicle as observed by an observer at rest on the ground? **(08 Marks)**

*****

CBCS Scheme

USN | | | | | | | | | | |

15CIV13/23

First/Second Semester B.E. Degree Examination, June/July 2017
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain briefly the scope of the following civil engineering fields:
i) Environmental engineering
ii) Transportation engineering **(06 Marks)**

b. Explain: i) Static and dynamics
ii) Kinematics and kinetics
iii) Couple and moment of couple **(06 Marks)**

c. Find the components of 100 N force shown in Fig.1(c) along general x and y axes shown.

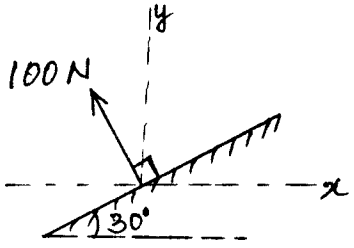


Fig.1(c) **(04 Marks)**

OR

2 a. Explain the terms: (i) Kerbs, (ii) Skew bridge, (iii) Spillways. (iv) Subgrade. **(08 Marks)**

b. With example, explain the characteristics of a force. **(04 Marks)**

c. Transfer the force acting at point A to the point B. Refer Fig.Q2(c).

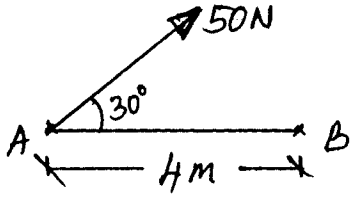


Fig.Q2(c) **(04 Marks)**

Module-2

3 a. Four coplanar concurrent forces are acting at a point '0' as shown in Fig.Q3(a). Determine the resultant completely.

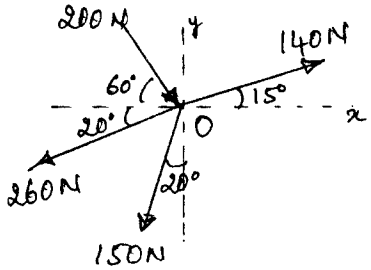


Fig.Q3(a) **(08 Marks)**

b. Explain: i) Angle of friction ii) Angle of repose
iii) Limiting friction iv) Coefficient of friction **(08 Marks)**

OR

4 a. Three cylinders A, B and C of diameter 200 mm, 300 mm and 250 mm and weight 75 N, 200 N and 100 N respectively are placed in a ditch as shown in Fig.Q4(a). Assuming contact surfaces smooth, determine the reaction between cylinder A and the vertical wall.

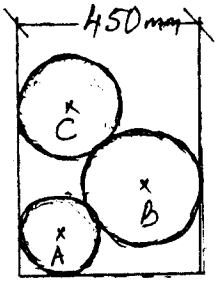


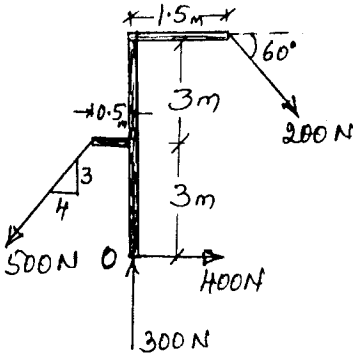
Fig.Q4(a) **(08 Marks)**

b. A pull of 180 N applied upward at 30° to a rough horizontal plane was required to just move a body resting on the plane, while a push of 220 N applied along the same line of action was required to just move the same body. Determine the weight of body and the coefficient of friction. **(08 Marks)**

Module-3

5 a. With the nature of reaction, explain: (i) fixed support, (ii) Hinged support, (iii) simple support. **(06 Marks)**

b. Determine completely the resultant of the system of four forces acting on the body shown in Fig,Q5(b) with respect to point '0'.



Fig,Q5(b) **(10 Marks)**

OR

6 a. Give the statement and application of Varignon's theorem. **(04 Marks)**

b. With sketch, explain space diagram (SPD) and free body diagram (FBD). **(04 Marks)**

c. Find the support reactions for the beam loaded as shown in Fig.Q6(c).

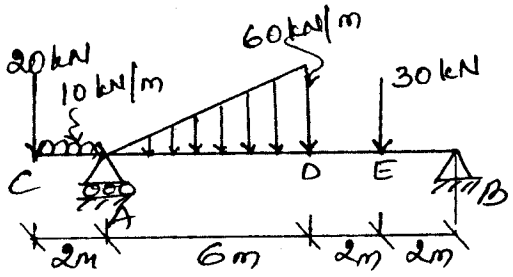


Fig.Q6(c) **(08 Marks)**

Module-4

7 a. State and prove parallel axis theorem. **(06 Marks)**

b. Locate the centroid of the plane area shown in Fig.Q7(b).

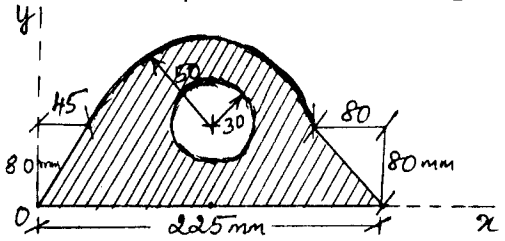


Fig.Q7(b) **(10 Marks)**

OR

8 a. Determine the centroid of a triangle by first principle. **(06 Marks)**

b. For the cross section shown in Fig.Q8(b), calculate the MI about the centroidal axis parallel to top edge. Also determine the radius of gyration.

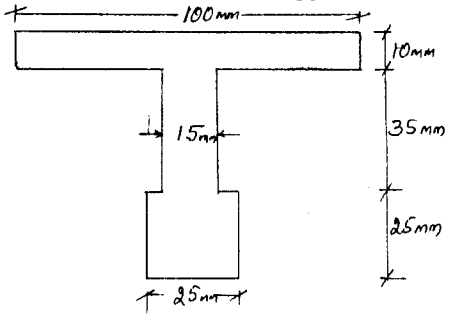


Fig.Q8(b) **(10 Marks)**

Module-5

9 a. A stone is dropped into a well. After 4 seconds the sound of splash is heard. If the velocity of sound is 330 m/sec, find the depth of the well up to water surface. **(10 Marks)**

b. Explain with a sketch for projectile motion:

i) Range ii) Time of flight

iii) Maximum height iv) Angle of projection **(06 Marks)**

OR

10 a. A stone is projected with a velocity of 20 m/sec perpendicular to the incline as shown in Fig.Q10(a). Determine the range R on the inclined plane.

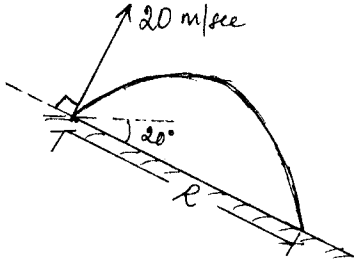


Fig.Q10(a) **(06 Marks)**

b. Explain: (i) Super elevation, (ii) Relative motion. **(04 Marks)**

c. A body moves in a straight line has the equation of motion given by $S = 2t^3 - 4t + 10$. Determine:

i) The time required for the body to gain a velocity of 68 m/sec starting from rest.

ii) The acceleration of the body when the velocity is equal to 32 m/sec. **(06 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15CIV13

First Semester B.E. Degree Examination, Dec.2015/Jan.2016
Elements of Civil Engineering & Engineering Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Briefly explain the scope of any four fields of civil engineering. **(08 Marks)**

b. Draw typical cross section of road and explain its components. **(08 Marks)**

OR

2 a. Write short notes on: i) Shoulders ii) Kerbs iii) Traffic separators. **(06 Marks)**

b. Resolve 300 N force acting on a block as shown in Fig. Q2 (b):
i) Into horizontal and vertical components.
ii) Along the inclined plane and right angles to the plane. **(10 Marks)**

Module-2

3 a. State and prove Lami's theorem. **(06 Marks)**

b. Determine the resultant of forces which are acting as shown in the Fig.Q3 (b). **(10 Marks)**

OR

4 a. State and prove Parallelogram law of forces. **(10 Marks)**

b. Explain with sketches : i) Cone of friction ii) Angle of repose. **(06 Marks)**

Module-3

5 a. State and prove Varignon's theorem. **(06 Marks)**

b. Find the magnitude, direction and position of the resultant with respect to the point A for the force system shown in Fig. Q5 (b). **(10 Marks)**

OR

6 a. Explain the different types of supports in the analysis of beams. **(06 Marks)**

b. Determine the support reaction at A and B for the beam shown in Fig. Q6 (b). **(10 Marks)**

Module-4

7 a. State and prove parallel axis theorem. **(08 Marks)**

b. Determine Centroid of the area shown in Fig. Q7 (b). **(08 Marks)**

OR

8 a. Determine the moment of inertia and radii of gyration of the area shown in Fig. Q8 (a) about the base AB and centroidal axis parallel to AB. **(08 Marks)**

b. Determine the moment of inertia of triangle of base width 'b' and height 'h' about the base. **(08 Marks)**

Module-5

9 a. Define : i) Displacement ii) Speed iii) Velocity iv) Acceleration. **(06 Marks)**

b. A cricket ball thrown from a height of 1.8 m above ground level at an angle of 30° with the horizontal with velocity of 12 m/s and is caught by fielder at a height of 0.6 m above the ground. Determine the distance between the two players. **(10 Marks)**

OR

10 a. A stone is dropped into a well and a sound of splash is heard after 4 s. Find the depth of well. **(08 Marks)**

b. Determine the position at which the ball in thrown up the plane will strike the inclined plane as shown in Fig. Q10 (b). The initial velocity is 30 m/s and angle of projection is $\tan^{-1}\left(\frac{4}{3}\right)$ with horizontal. **(08 Marks)**

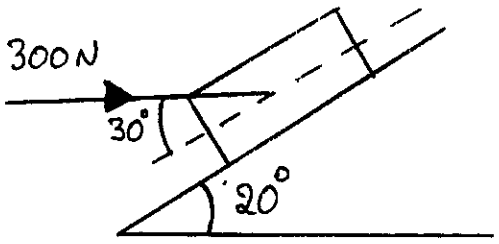


Fig. Q2 (b)

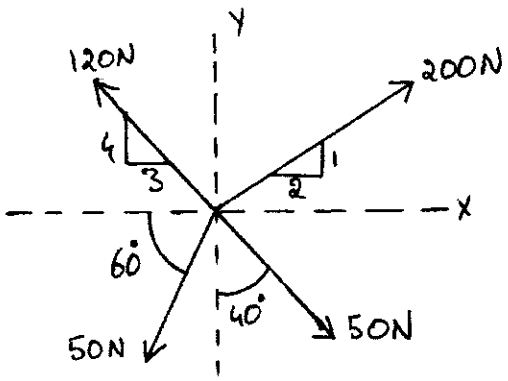


Fig. Q3 (b)

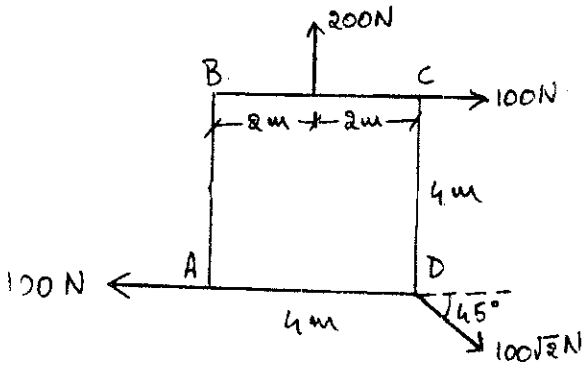


Fig. Q5 (b)

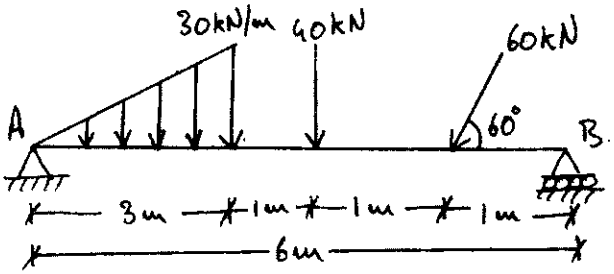


Fig. Q6 (b)

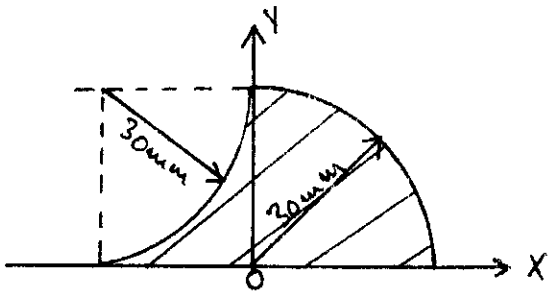


Fig. Q7 (b)

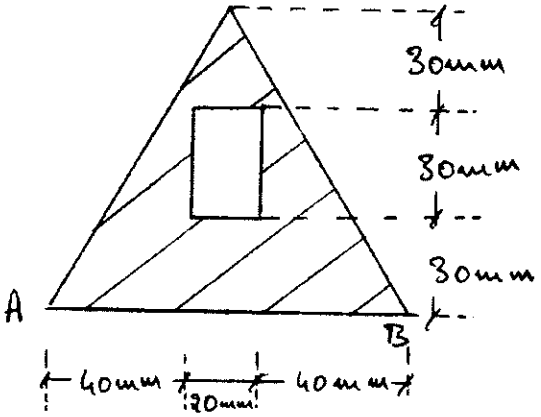


Fig. Q8 (a)

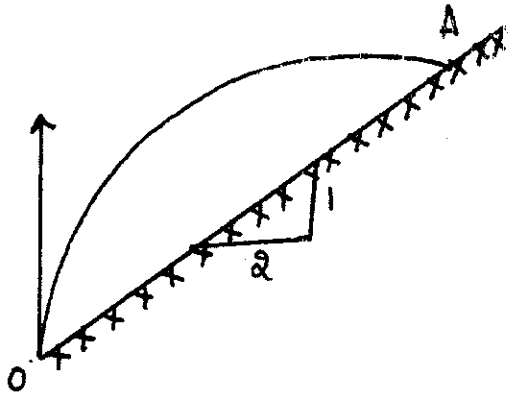


Fig. Q10 (b)

* * * * *

CBCS Scheme

USN | | | | | | | | | | |

15CIV13/23

First Semester B.E. Degree Examination, Dec.2016/Jan.2017
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

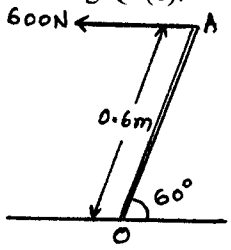
Module-1

1 a. Explain briefly the scope of the following civil engineering fields. **(04 Marks)**
i) Hydraulics ii) Transportation engineering.

b. Explain on what bases under which the dams are classified. **(05 Marks)**

c. Replace the horizontal force of 600N acting on the lever by an equivalent system consisting of a force and a couple at 0 as shown in fig.Q1(c). **(07 Marks)**

Fig.Q1(c)



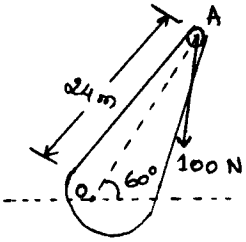
OR

2 a. Give the comparison of Flexible and Rigid pavements. Also give their advantages and limitations. **(04 Marks)**

b. List the various systems of forces with their characteristics and an example for each, with a neat sketch. **(05 Marks)**

c. A 100N vertical force is applied to the end of a lever which is attached to a shaft as shown in fig.Q2(c). Determine i) The moment of force about 0.
ii) The horizontal force applied at A which creates same moment about 0.
iii) The smallest force applied at A which creates same moment about 0. **(07 Marks)**

Fig.Q2(c)

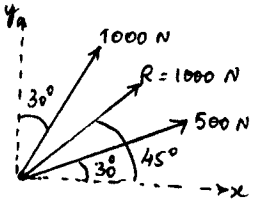


Module-2

3 a. State and prove Parallelogram law of forces. **(05 Marks)**

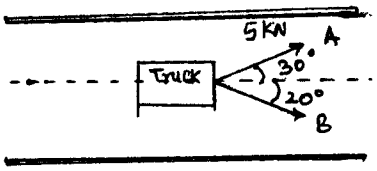
b. Two forces acting on a body are 500N and 1000N as shown in fig. Q3(b). Determine the third force F such that the resultant of all the three forces is 1000N directed at 45^0 to the x – axis. **(06 Marks)**

Fig.Q3(b)



c. A truck is to be pulled along a straight road as shown in fig. Q3(c).
i) If the force applied along rope A is 5kN inclined at 30^0, what should be the force in the rope B, which is inclined at 20^0, so that vehicle moves along the road.
ii) If force of 4kN is applied in rope B at what angle rope B should be inclined so that the vehicle is pulled along the road. **(05 Marks)**

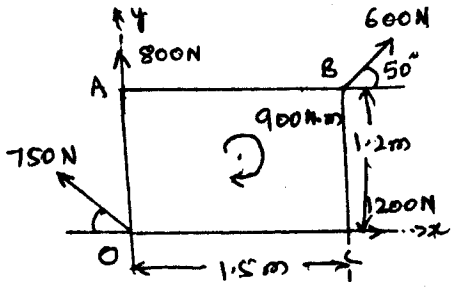
Fig.Q3(c)



OR

4 a. With a neat sketch, explain the basics of static friction and kinetic friction. **(03 Marks)**
b. A block of mass 10 kgs placed on an inclined plane is subjected a force F which is parallel to the plane. Taking inclination of the plane with respect to the horizontal as 30^0 and coefficient of friction between the block and the plane is 0.24. Determine the value of F for i) Impending motion of the block down the plane and ii) Impending motion of the block up the plane. Take acceleration due to gravity g = 9.81. **(05 Marks)**
c. Find the resultant of the force system acting on a body OABC as shown in fig.Q4(c). Also find the points where the resultant will cut the X and Y axis. **(08 Marks)**

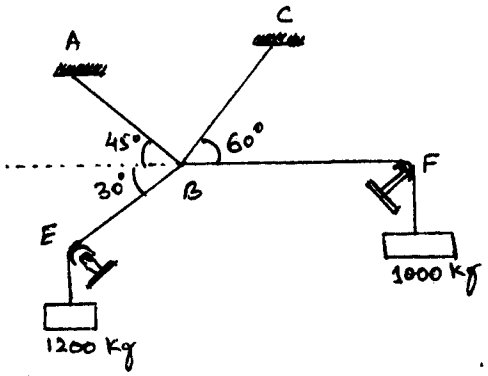
Fig.Q4(c)



Module-3

5 a. Explain the different types of supports and loads in the analysis of beams. **(06 Marks)**
b. Find the forces in cables AB and CB shown in fig.Q5(b). The remaining two cables pass over frictionless pulleys E and F and support masses 1200 kg and 1000kg respectively. **(10 Marks)**

Fig.Q5(b)

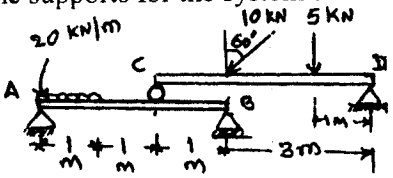


OR

6 a. Define Equilibrant. Explain the conditions for equilibrium of coplanar concurrent force system and coplanar non concurrent force system. **(06 Marks)**

b. Determine the reactions at the supports for the system shown in fig.Q6(b). **(10 Marks)**

Fig.Q6(b)

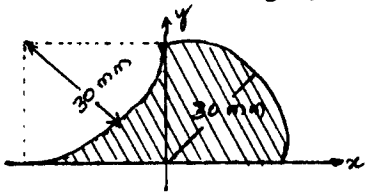


Module-4

7 a. Determine the Moment of inertia of a semi circle about centroid axis parallel to diameter by the method of integration. **(08 Marks)**

b. Determine the centroid of the lamina as shown in fig. Q7(b). **(08 Marks)**

Fig.Q7(b)

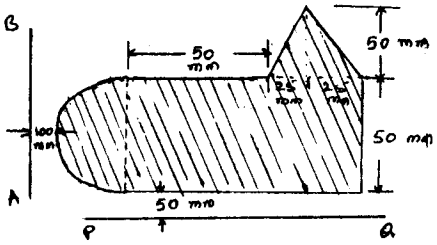


OR

8 a. Determine the centroid for sector of circle by the method of Integration. **(08 Marks)**

b. Find the moment of Inertia of hatched area shown in fig.Q8(b) about the axis PQ. Also determine the radius of gyration. **(08 Marks)**

Fig.Q8(b)



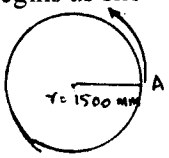
Module-5

9 a. Derive all three basic equations of motion in Kinematics. **(06 Marks)**

b. What is Super elevation and what is its necessity? **(04 Marks)**

c. A horizontal bar on length 1.5m rotates. It accelerates uniformly from 1200 rpm to 1500 rpm in an interval of 5 seconds. Find the linear velocity at the beginning and end of the interval. What are the normal and tangential components of the acceleration at the mid – point of the bar after 4 sec after the acceleration begins as shown in fig. Q9(c)? **(06 Marks)**

Fig.Q9(c)



OR

10 a. Derive the equation to the path of the projectile. **(08 Marks)**

b. A passenger and goods train are moving on a parallel track in same direction. The passenger train 250m length is moving with a constant velocity of 72 kmph. At an instant its engine approaches the last compartment of the goods train. After 25 sec. the engine starts overtaking the engine of goods train. It takes 30 seconds more to completely overtake the goods train. Find the length and speed of goods train. **(08 Marks)**

* * * * *