NARSIMHAREDDY ENGINEERING COLLEGE
(UGC AUTONOMOUS)

I B.Tech I Semester (NR23) Supplementary Examination, July 2024

ENGINEERING MECHANICS
(Common to CE, ME)

Time : 3 hours   Maximum marks: 60

Note:
- This question paper contains two parts, A and B
- Part A is compulsory which carries 10 marks (10 sub questions are two from each unit carry 1 Marks). Answer all questions in Part A
- Part B Consists of 5 Units. Answer one question from each unit. Each question carries 10 Marks and may have a, b sub questions

Part-A   **(10 Marks)**
Answer all questions

Q.No	Question	M	CO	BL
1) a.	What is the difference between collinear and concurrent forces?	1	CO1	L2
b.	State Varignon's theorem	1	CO1	L1
c.	Explain the laws of friction	1	CO2	L1
d.	Define center of gravity and center of mass.	1	CO2	L1
e.	What is inertia?	1	CO3	L1
f.	Justify the statement that all centroidal axes are not axes of symmetry	1	CO3	L2
g.	Differentiate between rectilinear motion and curvilinear motion	1	CO4	L1
h.	State the perpendicular axis theorem	1	CO4	L1
i.	Define work-energy principle	1	CO5	L1
j.	What is meant by Direct impact	1	CO5	L1

Part-B   **(50 Marks)**
Answer all the Units
All Questions carry equal Marks

Q.No	Question	M	CO	BL
	UNIT-I			
2) a.	Classify the system of forces with neat sketches	5	CO1	L2
b.	Determine the resultant of four forces concurrent at the origin as shown in figure below	5	CO1	L3

OR
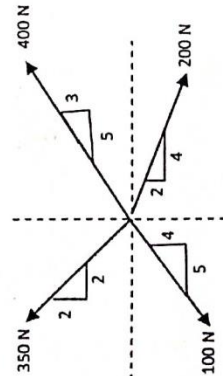
|		M	CO	BL
3)	Two smooth spheres P, Q each of radius 25 cm and weighing 500 N, rest in a horizontal channelhaving vertical walls as shown in figure below. If the distance between the walls is 90 cm. Calculatethe reactions at points of contact A,B and C	10	CO1	L3
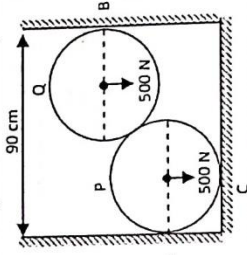
UNIT-II

4)	Explain friction with types and state the law of friction.	10	CO2	L3

OR

5)	Locate the centroid of the shaded area obtained by removing a semicircle of a diameter 'a' from aquadrant of a circle of radius 'a' as shown in figure below	10	CO2	L3
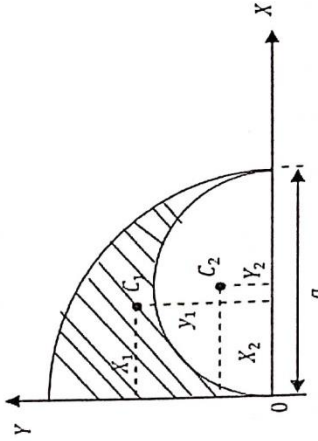
UNIT-III

6)	Calculate the mass moment of inertia of circular plate of radius R and thickness t about its centroidal axis.	10	CO3	L3

OR

7)	State and prove parallel axis theorem	10	CO3	L2

UNIT-IV
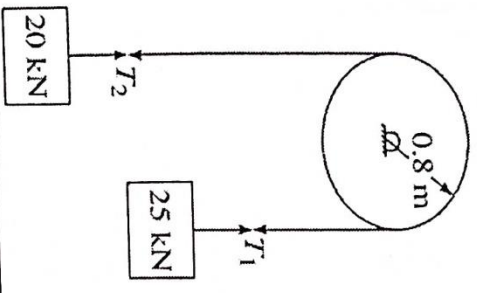
8)	A particle is dropped from the top of a tower 100 m high. Another particle is projected upwards at the same time from the foot of the tower and meets the first particle at a height of 30 m. Find the velocity with which the second particle is projected upwards. Take g = 9.8 m/s²	10	CO4	L3

OR

9)	Derive the expression of rotary motion by using D' Alembert's principle	10	CO4	L2

UNIT-V

10)	A 10 kN roller of radius 0.25 m is pulled with a force of 1.2 kN	10	CO5	L3

on a cricket pitch. If the roller starts from rest, determine the distance travelled by it when the velocity acquired is 3 m/s. Assume there is no slippage.

OR

11)	Determine the velocity of the blocks shown in Figure after t = 5 second, if the system starts from rest. It may be noted that the pulley is neither frictionless nor weightless. Assume the pulley as a ring of uniform-cross section.	10	CO5	BL3

20 kN — T_2 ϕ 0.8 m T_1 — 25 kN

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UGC AUTONOMOUS INSTITUTION
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Accredited by **NBA & NAAC** with **'A'** Grade
Approved by **AICTE**

(UGC AUTONOMOUS)

I B.Tech I Semester (NR21) Supplementary Examination, July 2024

ENGINEERING MECHANICS

(Common to CE, ME)

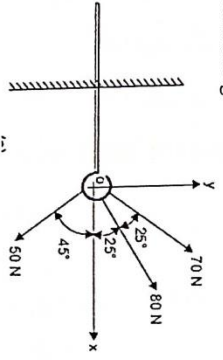**Time : 3 hours**   **Maximum marks: 70**

Note:
- This question paper contains two parts, A and B
- Part A is compulsory which carries 20 marks (10 sub questions are two from each unit carry 2 Marks). Answer all questions in Part A
- Part B Consists of 5 Units. Answer one question from each unit. Each question carries 10 Marks and may have a, b sub questions
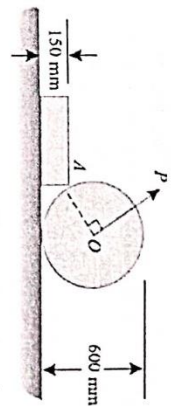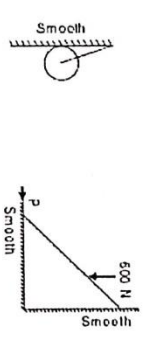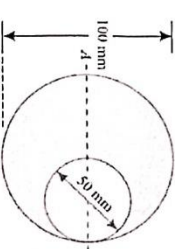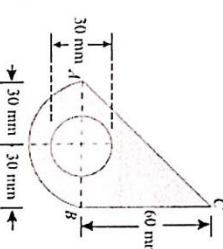
Part-A
Answer all questions   (20 Marks)

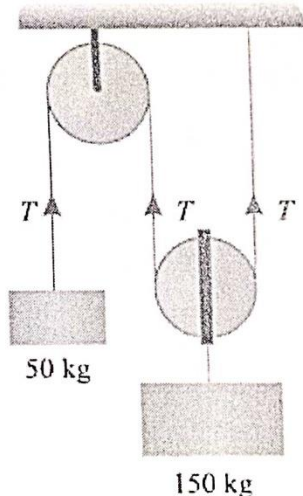| Q.No		Question	M	CO	BL
1)	a.	Differentiate coplanar and concurrent forces.	2	CO1	L2
	b.	Resolve the 50N force acting at 60° to horizontal into two components	2	CO1	L3
	c.	List the types of friction.	2	CO1	L2
	d.	Mention the laws of friction.	2	CO1	L2
	e.	Define area moment of inertia.	2	CO2	L2
	f.	Briefly discuss parallel axis theorem.	2	CO2	L2
	g.	Differentiate rectilinear motion and curvilinear motion.	2	CO2	L2
	h.	Mention Impulse – Momentum equation.	2	CO4	L2
	i.	Briefly discuss the types of motion.	2	CO5	L2
	j.	Give any two applications of work energy principle.	2	CO2	L2

Part-B
Answer all the Units
All Questions carry equal Marks   (50 Marks)

Q.No		Question	M	CO	BL
		UNIT–I			
2)	a.	Determine the resultant of the three forces acting on a hook as shown in Fig	5	CO1	L3

		OR			
	b.	State and prove the parallelogram law of forces	5	CO1	L3

3)	a.	A uniform wheel of 600 mm diameter, weighing 5 kN rests against a rigid rectangular block of 150 mm height as shown in Fig	5	CO2	L3

	b.	How can you resolve the forces if more than three forces are acting on a rigid body	5	CO2	L2
		Draw the Free body diagrams for the following			

		UNIT–II			
4)		A circular hole of 50 mm diameter is cut out from a circular disc of 100 mm diameter as shown in Fig Find the centre of gravity of the section from A	10	CO2	L3

		OR			
5)		An effort of 200 N is required just to move a certain body up an inclined plane of angle 15° the force acting parallel to the plane. If the angle of inclination of the plane is made 20° the effort required, again applied parallel to the plane, is found to be 230 N. Find the weight of the body and the coefficient of friction.	10	CO2	L3

		UNIT–III			
6)		Briefly discuss the theorems of moments of inertia.	10	CO3	L2
		OR			
7)		Find the moment of inertia of the lamina with a circular hole of 30 mm diameter about the axis AB as shown in Fig	10	CO3	L3

		UNIT–IV			
8)	a.	A ball is projected from a point with a velocity of 10 m/s on an inclined plane. The angle of projection and inclination of the plane are 35° and 15° respectively with the horizontal. Find the time of flight of the ball, when it is projected upwards and downwards the plane	5	CO4	L3
	b.	A shot is fired with a velocity if 30 m/s from a point 15 metres in front of a vertical wall 6 metres high. Find the angle of projection, to the horizontal for the shot just to clear the top of the wall.	5	CO4	L3
		OR			
9)	a.	Derive an expression for the maximum height and range of a projectile traversed by a stone, thrown with an initial velocity of u and an inclination of α	5	CO4	L3
	b	Derive the general equation of projectile motion.	5	CO4	L3
		UNIT–V			
10)		Determine the tension in the strings and accelerations of two blocks of mass 150 kg and 50 kg connected by a string and a frictionless and weightless pulley as shown in Fig	10	CO5	L3

50 kg

150 kg

		OR			
11)	a.	State and prove D'Alembert's Principle.	5	CO5	L3
	b.	Explain the concept of work energy application to particle motion	5	CO5	L3

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NARSIMHAREDDY ENGINEERING COLLEGE
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I B.Tech II Semester (NR20) Supplementary Examination, July 2024

ENGINEERING MECHANICS
(Common to CE, ME)

Time : 3 hours   Maximum marks: 75

Note:
- This question paper contains two parts, A and B
- Part A is compulsory which carries 25 marks (1st 5 sub questions are one from each unit carry 2 Marks each & Next 5 sub questions are one from each unit carry 3 Marks). Answer all questions in Part A
- Part B Consists of 5 Units. Answer one full question from each unit. Each question carries 10 Marks and may have a, b sub questions

Part-A
Answer all questions   (25 Marks)

Q.No		Question	M	CO	BL
1)	a.	Distingush between moment and couple.	2	CO1	L2
	b.	State parallelogram law of forces.	2	CO1	L1
	c.	What are the centroidal coordinates of a right angle triangle of base 6m and height 9m placed in first quadrants?	2	CO2	L2
	d.	What is the relation between coefficient of friction and friction angle?	2	CO2	L2
	e.	What is the second moment of area of a quarter circle area about its radial axis?	2	CO3	L1
	f.	Define the term Polar Moment of Inertia.	3	CO3	L1
	g.	If a stone falls past a window of 2.45 m height in half a second, find the height from which the stone fell.	3	CO4	L1
	h.	Define kinetic energy and potential energy	3	CO4	L1
	i.	State D'Alemberts principle.	3	CO5	L1
	j.	The motion of a particle is defined by the relation $x = t^3 - 15t^2 - 20$, where 'x' is expressed in meters and 't' in seconds. Determine the acceleration of the particle at t= 3 seconds.	3	CO5	L2

Part-B
Answer all the Units
All Questions carry equal Marks   (50 Marks)

Q.No	Question	M	CO	BL
	UNIT-I			
2)	A system of four forces acting on a body is as shown in Fig. Determine the resultant.	10	CO1	L3

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3)	a.	Explain free body diagram	5	CO1	L2
		OR			
	b.	A roller of radius r=304.8 mm and weight Q=2225 N is to be pulled over a curb of height h=152.4 mm by a horizontal force P applied to the end of a string wound around the circumference of the roller as shown in fig.. Find the magnitude of P required to start the roller over the curb.	5	CO1	L3

UNIT-II

4)	Two blocks of weights W_1 and W_2 rest on a rough inclined plane and are connected by a short piece of string as shown in figure. If the coefficient of friction are $\mu_1=0.2$ and $\mu_2=0.3$ respectively, find the angle of inclination of the plane for which sliding will impend. Assume $W_1=W_2=50K$ N.	10	CO2	L3

OR

5)	Referring to the figure , determine the coordinates x_c and y_c of the center of a 100mm diameter, circular hole cut in a 150X200 mm thin plate so that this point will be the centroid of the remaining shaded area.	10	CO2	L3

UNIT-III

| 6) | Determine the moment of inertia of a section as shown in fig about centroidal axes. | 10 | CO3 | L3 |

OR

| 7) | Determine the second moments about x- and y-axis of the area enclosed within a curve $y=x^2/a$ and a straight line $y = x$ as shown in Fig. | 10 | CO3 | L3 |

UNIT-IV

| 8) | a. | Three perfectly elastic balls A, B and C of masses 2 kg, 6 kg and 10 kg are moving in the same direction with velocities 12 m/sec, 4 m/sec and 2 m/sec respectively. If the ball A strikes with the ball B, which in turns, strikes with ball C, find the velocities after impact? | 5 | CO4 | L3 |
| | b. | A ball of mass 100 gm strikes directly another ball of same mass, which is at rest. The first ball is reduced to rest by the impact. Find the loss of kinetic energy if the coefficient of restitution is $\frac{1}{\sqrt{3}}$. | 5 | CO4 | L3 |

OR

| 9) | a. | A bullet travelling horizontally with a velocity of 600 m/s and weighing 0.25 N strikes a wooden block 50 N resting on around horizontal floor. The coefficient of friction between the floor and the block $\mu=0.5$. Find the distance through which the block is displaced from its initial position. | 5 | CO4 | L3 |
| | b. | A train of weight 2000 KN is pulled by an engine on a level track at a constant speed of 36 kmph. The resistance due to friction is 10 N per KN of the trains weight. Find the power of the engine. | 5 | CO4 | L3 |

UNIT-V

| 10) | Two bodies weighing 25N and 20 N are connected to the ends of an inextensible string, which passes over a smooth pulley. The weight 25 N is placed on a 20o inclined plane while the weight 20 N is hanging over the pulley. Determine (i) Acceleration of the system when 25 N moves up (ii) Tension in the string. | 10 | CO5 | L3 |

OR

| 11) | A two step pulley supports two weighs P and Q as shown in figure. Find the downward acceleration of P. Assume P =40 N, Q = 60 N and $r_1 = 2r_2$. Neglect friction and inertia of the pulleys | 10 | CO5 | L3 |

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JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITY HYDERABAD
**B.TechIYearIISemesterExaminations,September/October-2021 ENGINEERING
MECHANICS
(CommontoCE,ME, MCT,MMT,AE,MIE)**
Time:3Hours   Max.Marks:75
Answer   any   five   questions
Allquestionscarryequalmarks

1.a)Explainthe reactiveforcebetweentwo smoothsurfacesincontact witheach other.

 b)A rope is tied horizontally between two buildings 30 m apart. A weight of 200 N is attached to it at its midpoint. Determine the angle the rope would make with the horizontal, if the tension developed in the rope is three times the weight of the body. Assumethestringto beinextensibleand neglect its weight. Also determine byhowmuch the weight would sag.   [7+8]

2.a)   Asystemoffourforcesactingonabody isshowninfigure1.Determinetheresultant force and its direction.

Figure:1
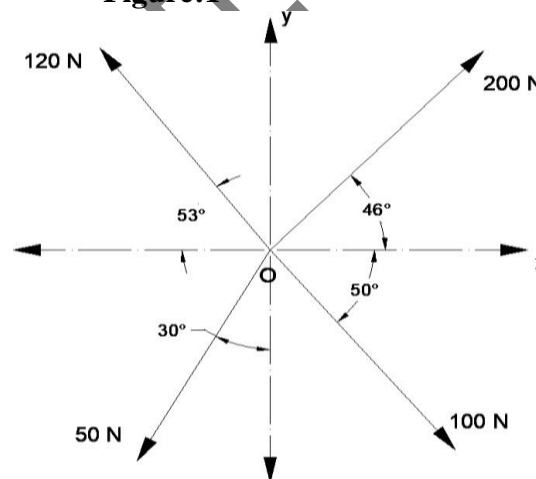
 b)Explainthestepsto befollowedwhile drawingfreebodydiagram.   [8+7]

3.a)   FindthecoordinatesofthecentroidoftheshadedareaKshowninfigure2.Thecurve OAB is a quarter circle with radius 200 mm, and OCB is a semicircle of radius 100 mm.