SHRI SHANKARACHARYA INSTITUTE OF PROFESSIONAL MANAGEMENT AND TECHNOLOGY		
DEPARTMENT OF MECHANICAL ENGINEERING		
Class Test – II	Session- July-December, 2021	Month- December, 2021
Semester 5th	Subject- Dynamics of Machines	
Code – 037514(037)	Time Allowed: 2 Hours	Max Marks: 40

Note: - Part A of questions 1 and 2 is compulsory, from other parts B, C and D of questions 1 and 2, attempt any two parts.
Ignore the columns of Level of Bloom's taxonomy and CO.

Q. No	Questions	Marks	Levels of Bloom's taxonomy	CO
	Question – 1			
1.A	Write the expressions for the velocity and acceleration of piston and expressions for angular velocity and angular acceleration of connecting rod.	4	R	5
1.B	Turning moment curve for an engine is represented by equation $T= (20000+9500\sin 2\Theta-5700\cos 2\Theta)$ Nm, where is the angle moved by crank inner dead centre. If resisting torque is constant, find (i) Power developed by engine, (ii) moment of inertia of flywheel in kg-m^2 if total fluctuation of speed is not to exceed 1% of mean speed which is 180rpm (iii) Angular acceleration of flywheel when crank has turned 45^0 from inner dead centre.	8	U	5
1.C	Derive with suitable diagram the expressions for piston effort, force acting along the connecting rod, thrust on the sides of cylinder walls in a piston cylinder mechanism neglecting the weight of the connecting rod.	8	U	5
1.D	Turning moment area for revolution of a multi cylinder engine with reference to mean turning moment in square centimeter are: -0.32, 4.08, -2.67, 3.33, -3.1, 2.26, -3.74, 2.74, -2.58 Scales for ordinate and abscissa are 1cm=14degree and 1cm=6000Nm. Mean speed is 200rpm, with 1.5% fluctuation. If hoop stress in rim material is not to exceed 56 bar, find diameter and cross section of rim of flywheel. Density of rim material is 0.067kg/cm^3.	8	U	5

P.T.O.

Question – 2				
2.A	Derive the expression for the gyroscopic couple.	4	R	3
2.B	A rail car has a total mass of 4000kg.There are two axles, each of which together with its wheels and gearing has a total mass moment of inertia 30kgm^2. Centre distance between the two wheels on an axle is 1.5m and each wheel is 46.5cm radius. Each axle is driven by a motor, speed ratio is 1:3. Each motor with its gear has a mass moment of inertia of 15kgm^2 and runs in direction opposite to that of axle. The Centre of gravity of car is 105cm above the rails. Determine the limiting speed of this car when rounding a curve of 300m radius such that no wheel leaves the rail.	8	U	3
2.C	The rotor of the turbine of a ship has a mass of 2500kg and rotates at a speed of 3200rpmcounterclockwise when viewed from the stern. The rotor has radius of gyration of 0.4m. determine gyroscopic couple and its effect when (i) ship steers to the left in a curve of 80m radius at a speed of 15knots(1 knot=1860m/h (ii) the ship pitches 5 degrees above and 5 degrees below the normal position and the bow is descending with its maximum velocity the pitching motion is simple harmonic with a periodic time of 40 seconds(iii) the ship rolls and at the instant its angular velocity is 0.4 rad/s clockwise viewed from stern. Also find maximum angular acceleration during pitching.	8	A	3
2.D	An aeroplane flying at 240km/hr turns towards left and completes a quarter circle of 60m radius. The mass of rotary parts of engine and propeller of plane amounts to 450kg with a radius of gyration of 320mm.Engine speed is 2000rpm clockwise when viewed from rear. Calculate (i) gyroscopic couple on aircraft and state its effect .In what way is the effect changed when the aeroplane turns towards right. If the engine rotates in clockwise direction when viewed from front (nose) and aeroplane turns left and then right.	8	A	3

SHRI SHANKARACHARYA INSTITUTE OF PROFESSIONAL MANAGEMENT AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

Class Test – II	Session- 2021-22	Month- DEC
Sem- 5	Subject- ICE	
Code - **C037511(037)**	Time Allowed: 2 hrs	Max Marks: 40

Note: - ***Part A of questions Unit III andUnit IV is compulsory, from other parts B, C and D, attempt any two parts.***

Q. No	Questions	Marks	Levels of Bloom's taxonomy	CO
	Unit – III			
1.A	What do you mean by MPFI system? What do you mean by nozzle lip? What are the factors affecting carburetion?	**4**	Remembering	CO4
1.B	Discuss the air fuel ratio requirements of a petrol engine from no load to full load?	**8**	Remembering	CO4
1.C	What is petrol injection? What are its advantages and disadvantages?	**8**	Remembering	CO4
1.D	Determine the size of fuel orifice to give A:F=12:1. The diameter of venturi throat is 3.5cm and vacuum at the venturi is 6.9cm of Hg. The pressure and temperature of atmospheric air ore 1.013 bar and 25C. the nozzle lip=5mm Take the following Cd_a=0.9,Cd_f=0.7 and e_f=760kg/m3. Consider the compressibility of air	**8**	Applying	CO4
	Unit – IV			
2.A	What do you understand by ignition? Describe the battery ignition system with the help of sketch?	**4**	Remembering	CO5
2.B	Define wet sump lubrication. What are their varieties? Explain anyone with suitable figure	**8**	Remembering	CO5
2.C	Why cooling of an I.C engine is necessary? Discuss the disadvantages of overcooling? Describe with a sketch thermostatically controlled forced circulation system?	**8**	Remembering	CO5
2.D	Discuss the various methods of control for exhaust emission from petrol engines?	**8**	Remembering	CO5

SHRI SHANKARACHARYA INSTITUTE OF PROFESSIONAL MANAGEMENT AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

Class Test – II	Session- July-December 2021	Month- December
Sem- 5th	Subject- Fluid Machines	
Code :- C037512(037)	Time Allowed: 2hr.	Max Marks: 40

Note: - 1.first Question (A) from both unit are compulsory.
2. Solve any two from B,C,D of each unit.

Q. No	Questions	Marks	Levels of Bloom's taxonomy	CO
	Unit – I			
1.A	Define the Following: (i) Cavitation. (ii) Net positive Suction Head.	**4**	R	6
1.B	Explain the Construction and working Centrifugal Pump with the help of neat sketch.	**8**	U	6
1.C	A centrifugal pump delivers water against a net head of 14.5 meters and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30° at the outlet. The impeller diameter is 300 mm and outlet width are 50 mm. Determine the discharge of the pump if manometric efficiency is 95%.	**8**	Ap	6
1.D	Derive an Expression for "Minimum speed of Centrifugal pump to start the Pump"	**8**	U	6
	Unit – II			
2.A	Explain the Ideal Indicator Diagram.	**4**	R	7
2.B	A single-acting reciprocating pump has a plunger of 10 cm diameter and a stroke of length 200 mm. The center of the pump is 4 m above the water level in the sump and 14 m below the level of water in a tank to which water is delivered by the pump. The diameter and length of suction pipe are 40 mm and 6 m while of the delivery pipe are 30 mm and 18 m respectively. Determine the maximum speed at which the pump may be run without separation if the separation pressure head 2.3m of water(absolute). Take atmospheric pressure head = 10.3 m of water.	**8**	Ap	7
2.C	Explain the working and construction of Air Vessel.	**8**	R	7
2.D	A single-acting reciprocating pump has a stroke length of 15 cm. The suction pipe is 7 meter long and the ratio of the suction diameter to the plunger diameter is 3/4. The water level in the sump is 2.5 meters below the axis of the pump cylinder, and the pipe connecting the sump and pump cylinder is 7.5 cm diameter. If the crank is running at 75 r.p.m., determine the pressure head on the piston:(i) in the beginning of the suction stroke,(ii) in the end of the suction stroke, and (iii)in the middle of the suction stroke. Take co-efficient of friction as 0.01.	**8**	Ap	7

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DEPARTMENT OF MECHANICAL ENGINEERING

Class Test – II	Session- July-Dec 2021	Month- Dec
Sem- 5th	Subject- Operation Research	
Code – C037531()37)	Time Allowed: 2 hrs	Max Marks: 40

Note: - 1. Students are Required to focus on question and marks columns only.
2. Question A is compulsory and attempt any one from B & C.

Q. No	Questions	Marks	Levels of Bloom's taxonomy	CO
	Unit – II			
1.A	State the difference between the Transportation and Assignment problem.	**4**	Understanding	CO2
1.B	Five wagons are available at station 1,2,3,4 and 5 .these are required at five station I,II,III,IV,and V .The mileages between various stations are given by the table below. How the wagons should be transported so as to minimize the total covered? I II III IV V 1 10 5 9 18 11 2 13 9 6 12 14 3 3 2 4 4 5 4 18 9 12 17 15 5 11 6 14 19 10	**16**	Applying	CO2
1.C	Four different jobs can be done on four different machines. The set-up and take down time costs are assumed to be prohibitively high for changeovers. The Matrix below gives the cost in rupees of producing jobs i on machine j. M1 M2 M3 M4 J1 5 7 11 6 J2 8 5 9 6 J3 4 7 10 7 J4 10 4 8 3 (i) How should the jobs be assigned to the various machine so that the total cost is minimized? Also formulate the mathematical model for the problem. (ii)Explain the rationale of assignment algorithms	**16**	Applying	CO2

	Unit – IV			
2.A	Write short notes on PERT, CPM, DUMMY, LOOPING.	**4**	Understanding	CO4
2.B	The following table gives data on normal time and cost and crash time and cost for a project:	**16**	Applying	CO4

Activity	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (Days)	Cost (Rs.)
1-2	6	60	4	100
1-3	4	60	2	200
2-4	5	50	3	150
2-5	3	45	1	65
3-4	6	90	4	200
4-6	8	80	4	300
5-6	4	40	2	100
6-7	3	45	2	80
		470		

The indirect cost per day is Rs. 10.

(i) Draw the network for the project
(ii) Find the critical path
(iii) Determine minimum total time and corresponding total cost.

2.C

Activity	to	tm	tp
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(a) Draw a network to represent the project the project
(b) Identify the critical path.
(c) Compute the earliest start time(EST), earliest finish time (EFT), latest start time (LST) and latest finish time (LFT) for each event.
(d) Compute the total float.

16 | Applying | CO5

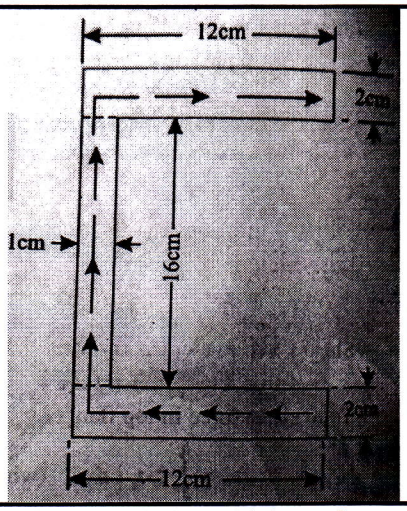
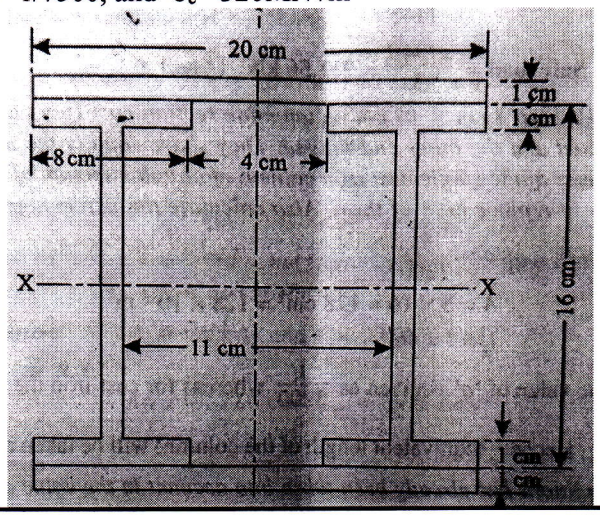
SHRI SHANKARACHARYA INSTITUTE OF PROFESSIONAL MANAGEMENT AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

Class Test: II	Session: July-January 2021	Month: December
Sem- 5th Sem	Subject: Solid Mechanics	
Code – C037512(037)	Time Allowed: 2 hrs	Max Marks: 40

Note: - Attempt all question. Parts (a) are compulsory of each question. Solve any two parts from (b), (c) and (d) of each question.

Q. No	Questions	Marks	Levels of Bloom's taxonomy	CO
	Unit – I			
1.A	Differentiate between thin and thick shell and give expression for circumferential and hoop strain in thin cylinder.	**4**	Remembering	CO1
1.B	Write the assumption made in lame's theory for thick cylinder. Derive expression for radial and hoop stresses along thickness of thick cylinder.	**8**	Creating	CO2
1.C	A cylindrical shell 90 cm long and 20 cm internal diameter having thickness of metal as 8 mm is filled with fluid at atmospheric pressure. If an additional 20 cm^3 of fluid is pumped into the cylinder, find (i) the pressure exerted by the fluid on the cylinder and (ii) the hoop stress induced.	**8**	Understanding	CO1
1.D	A thick walled closed-end cylinder is made of an Al-alloy (E = 72 GPa, 1/m= 0.33), has inside diameter of 200 mm and outside diameter of 800 mm. The cylinder is subjected to internal fluid pressure of 150 MPa. Determine the principal stresses and maximum shear stress at a point on the inside surface of the cylinder. Also determine the increase in inside diameter due to fluid pressure.	**8**	Analyzing	CO2
	Unit – II			
2.A	What is Slenderness ratio and write equivalent length for different end conditions of column.	**4**	Remembering	CO2
2.B	Write the assumptions of Euler's theory for long column. Also deduce the expression for Euler crippling load for column with one end fix and other end free.	**8**	Analyzing	CO1
2.C	Derive the expression for shear centre of channel section. Also calculate the shear centre of channel section given in figure:	**8**	Understanding	CO3

				
2.D	A column is made up of two rolled steel joists of I-section; 16 cm x 8cm x 1cm thick with plate 20 cm x 1 cm riveted with flanges one each on the top and on the bottom. The edges of the plates being flush with the outside edges of joists' flanges. Determine, by Rankine's formula the safe load the column of 4 m length, with both ends fixed, can carry with factor of safety 3. Take; a= 1/7500, and σ_c= 320MN /m^2 	**8**	Creating	CO2